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DYNATECH R/D CO. CAMBRIDGE MASS
BUILDING INSULATION MATERIALS COMPILATION.(U)
SEP 79 J G BOURNE, D L BROWNELL, E C GUYER

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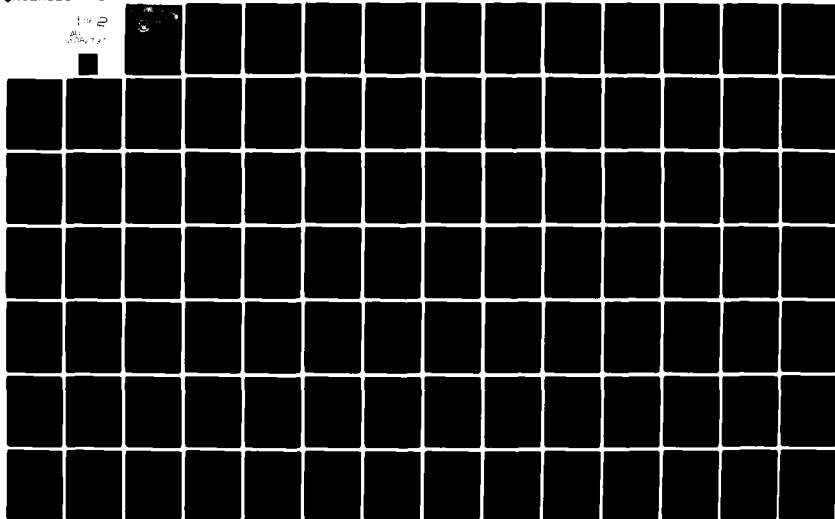
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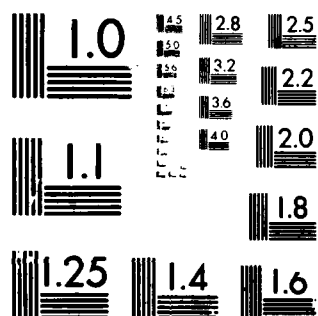
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CIVIL ENGINEERING LABORATORY
Naval Construction Battalion Center
Port Hueneme, California

Sponsored by
NAVAL MATERIAL COMMAND

BUILDING INSULATION MATERIALS COMPELATION

January 1980

An Investigation Conducted by
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Where possible the generic properties of a particular insulating material are presented to allow the designer to draw comparisons between types. In addition, where data are available, the variation of conductivity with temperature and/or density is given for each generic material.

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Section 1

INTRODUCTION

1.1 Purpose

In recent years there has been a significant emphasis placed on the reduction of thermal losses from heated and air conditioned buildings. This has created a need for information on the properties of insulating materials available to the construction industry.

The Civil Engineering Laboratory (CEL), of Port Hueneme, CA, as part of its building energy conservation program, has enlisted the services of Dynatech R/D Company, Cambridge, MA, under Contract No. N68305-79-C-0008 to prepare a compilation of building insulation material properties. This document is intended to provide a ready source of the thermal characteristics, availability, safety and other pertinent information for the selected types of insulation.

Although every effort has been made to accurately report the data provided by the manufacturers, neither Dynatech nor the Navy Civil Engineering Laboratory shall be liable for any errors or omissions in the compilation or for any consequences evolving from the use of such information presented in this report.

1.2 Scope of Compilation

This report covers all commonly used types of products whose primary purpose is to provide thermal resistance to heat flow through the building envelope. Due to the importance of controlling the migration of moisture to the insulating material, vapor barriers are also presented.

Where possible the generic properties of a particular insulating material are presented to allow the designer to draw comparisons between types. In addition, where data are available, the variation of conductivity with temperature and/or density is given for each generic material.

Section 2

USING THE COMPILATION

2.1 General

This compilation has been formulated to provide the building designer with a powerful and time saving tool for the selection of building insulating materials. An attempt has been made to address each phase of the selection process. This includes deciding which types of insulation are most suitable for the given application and design conditions, selecting a particular manufacturer's product and locating the plants which can supply the desired insulation most efficiently.

The designer who wishes to compute the overall thermal transmittance (U-value) of walls, roofs or other composite systems is referred to the ASHRAE Handbook of Fundamentals (1977) (Ref. 1).

2.2 Structure of Compilation and Data Format

Four groups of information are presented in this document. Sections 1 and 2 discuss the background and structure of the compilation and develop methods for efficiently selecting insulation.

Section 3 provides a description of the generic materials contained in this report. The salient features of each material are discussed including thermal properties, available forms, typical applications and potential safety hazards. After each description is a table of typical properties for the material and (where data are available) plots are given to characterize the variations in the thermal conductivity of the material as a function of density and temperature.

Next follows a comparison table which summarizes the important differences between various insulating materials. This is followed by a table specifying major applications by type.

Section 4 is the compilation of the manufacturer's product data. This has been categorized according to the form of insulation as shown in the table of contents. For a given form the insulations are sub-divided by the material and then listed alphabetically by the company name.

The data are given in U.S. customary units* with each parameter defined in Section 4.1. In each table R-values for specified thicknesses are given in the first column followed by the thickness and the mean temperature of the insulation as measured.

*The building industry, and thus the insulation manufacturers, has not as yet made any conversion to metric units. Thus, data are not available in this form from the manufacturers nor useable by the engineers who will apply this manual. Conversion factors are given in Appendix A.

The "apparent" thermal conductivity can always be used to compare the insulation efficiency in reducing heat flow. It should be pointed out that although the thermal conductivity is normally stated in terms of one inch of thickness, the actual conductivity may be a function of the thickness. Thus two inches of insulation may have less than twice the resistance of a one inch layer. This "effect of thickness" (Ref. 7) becomes most important as the density of fibrous insulation decreases and as the cell size in foams increases, especially at elevated temperatures. This is a result of the mixed mode heat transfer process which occurs in these insulations (conduction and radiation) as opposed to the pure conduction occurring in a homogeneous opaque solid substance. With this in mind it is always desirable to use data from measurements taken near the thickness of use.

The manufacturers often produce many standard sizes and thicknesses of insulation. However the data reported in this compilation are intended to represent the characteristics of the materials only at those sizes for which verification tests are available.

The appendices contain conversion tables, material specifications, an alphabetical address list of the manufacturers that produce the materials in Section 4 and a description of the procedure by which these document data were compiled.

2.3 Procedure for Selecting Insulations

Several criteria may be used in selecting the most suitable insulating material for a particular application. The primary restriction is often the specific structural component of the building envelope to be insulated. For example, it is usually impractical to use batts to retrofit an existing wall whereas either pneumatically blown or foamed insulations can readily be applied.

Tables 3.2 and 3.3 can be used as a means of reducing the number of forms of insulation to be considered. The cost data provided in Table 3.2 should be used only as a first approximation of the installed cost of the various insulations. The actual cost will depend on the regional availability, local labor costs and on the individual contractors charge rates, as well as the degree of difficulty of a particular job.

The materials being considered can be examined in more detail in the generic materials properties section (3.1). Here the effects of moisture and aging are given as well as the fire resistance and safe temperature limits.

The manufacturers product listings in Section 4 can now be examined for each of the forms of insulation which still appear to be suitable for a particular application. The designer may find it useful to refer to the address list in the appendix to determine which manufacturers are located in his vicinity, keeping in mind that many larger manufacturers have sales offices countrywide.

Before the final selection, the designer will wish to contact the manufacturer to obtain the current pricing and availability.

2.4 Useful Equations

Certain pertinent equations occur frequently in designing insulating systems. This section will point out the relationships between the important thermal parameters and a sample problem will be solved to illustrate the use of this compilation.

As stated earlier, the thermal conductivity of insulating materials is actually a misnomer since radiation and convection can play a role. However in this report the terms "thermal conductivity" and "apparent thermal conductivity" will be used interchangeably to represent the thickness of material divided by its thermal resistance.

The thermal resistance of a section is equal to the inverse of the conductance. These quantities can be expressed as:

$$k = C t$$

and

$$R = \frac{1}{C} = \frac{t}{k}$$

The accepted U.S. customary unit for the thermal conductivity of insulations is BTU-in/hrft²°F.

2.5 Temperature Correction

Sample Problem 1: A sample of fiberglass batt insulation has a thermal conductivity of 0.33 BTU-in/hrft²°F at a density of 0.70 lb/ft³ and 75°F. Estimate its conductivity in S.I. units at 0°F.

Solution: From Figure 3.1.3 (p. 14) for fiberglass the conductivity is found to be 0.312 at 75°F and 0.233 at 0°F. If the conductivity vs temperature curves for the sample and generic material are assumed to be of the same form, then the sample's conductivity at 0°F can be approximated by:

$$k_{\text{sample}} (0^\circ\text{F}) \approx k_{\text{generic}} (0^\circ\text{F}) \frac{k_{\text{sample}} (75^\circ\text{F})}{k_{\text{generic}} (75^\circ\text{F})}$$

$$k_{\text{sample}} (0^\circ\text{F}) \approx 0.233 \frac{0.33}{0.312} = 0.25 \frac{\text{BTU-in}}{\text{hrft}^2\text{°F}}$$

Using the conversion tables from the appendix yields a value of 0.012 W/m² C.

Section 3

GENERIC BUILDING INSULATION INFORMATION

3.1 Material Properties

This section presents typical data for the properties of the generic types of insulating materials included in this compilation. These data are presented in the form of a brief discussion of the key characteristics of each material followed by tabular and graphical property data.

Where applicable, variations of the apparent conductivity as a function of density and temperature are given. The architectural design will find this information helpful in estimating the performance of the insulation under conditions other than those specified by the manufacturer.

3.1.1. Cellular Glass

Cellular glass insulation is a rigid material formed by blowing glass (usually with H_2S) into a very fine celled foam. Being an entirely closed cell non-organic substance, cellular glass is impervious to moisture and is non-combustible.

Typical applications of cellular glass insulation includes uses in overdeck assemblies, load bearing floors and as a wall siding material. With its compressive strength of 100 psi and its impermeability to moisture, cellular glass can also be used as a plaza or parking deck insulation.

The apparent thermal conductivity of cellular glass at a density of 8.5 lbs/ft³ is between 0.36 and 0.38 BTU-in/hrft²°F. This yields a thermal resistance of 2.8 to 2.6 hrft²°F/BTU per inch of thickness.

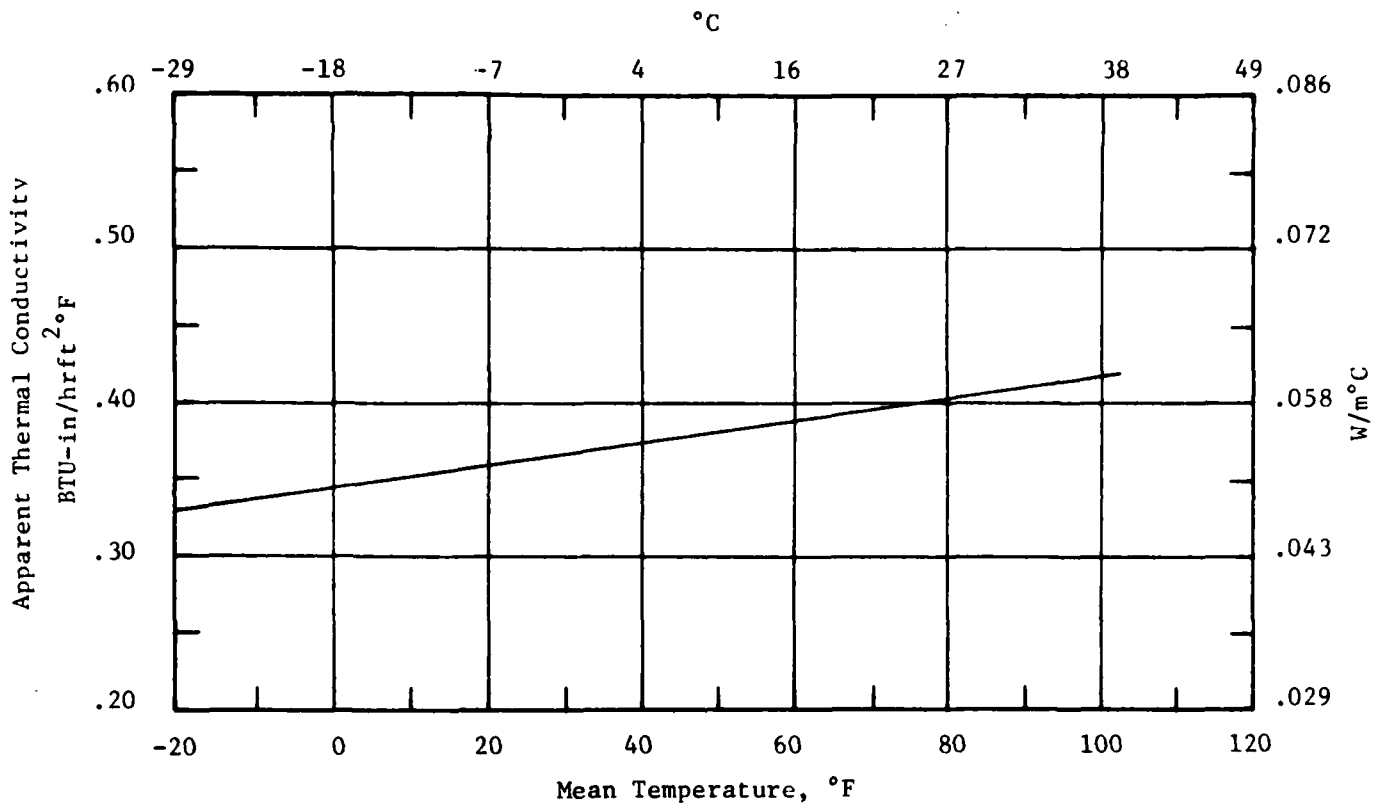
Cellular glass does not exhibit either reduced thermal performance or dimensional change due to aging, however, repeated freeze-thaw cycling while in contact with water can induce fracturing of the insulation.

Table 3.1.1. Cellular Glass

Material Property	Value*	Test Method
Density	8.5 lb/ft ³	ASTM C-303
Closed Cell Content	100%	
Thermal Conductivity (k factor) at 75°F	0.38 BTU-in/hrft ² °F	ASTM C-177, C-518
Thermal Resistance (R-value) per 1" thickness at 75°F	2.63 BTU-in/hrft ² °F	
Constant Pressure Specific Heat at 75°F	0.18 BTU/lbm°F	
Water Vapor Permeability	0.00 perm-in	ASTM C-355
Water Absorption	Non-absorptive - only surface water retained	
Capillarity	None	
Compressive Strength	100 psi	ASTM C-165
Fire Resistance	Non-combustible	ASTM E-136
Flame Spread	5	ASME 84
Fuel Contributed	-	ASME 84
Smoke Developed	0	ASME 84
Temperature Range	< 900°F	
Effect of Age		
Dimensional Stability	None	
Thermal Performance	None	
Fire Resistance	None	
Degradation Due to:		
Cycling	Freeze thaw damage possible under extreme conditions when in con- tact with water	
Vermin	No food value	
Moisture	None	
Fungal/Bacterial	Does not promote growth	
Weathering	None	
Corrosiveness	None	
Human Factors		
Toxicity	Not toxic	
Odor	Slight H ₂ S odor if cells rupture during installation	
Sound Absorption	Fair	
Specifications:	Federal HH-I-551E ASTM C-522	

*From Pittsburgh Corning Literature.

Figure 3.1.1
Cellular Glass



Source: Reference 1.

3.1.2 Cellulosic

Cellulosic insulation is manufactured by shredding and milling recycled paper or wood pulp into a fluffy, low density material. Chemicals are added to provide resistance to fire, moisture absorption and fungal growth.

The major usage of cellulosic insulation is as a loose fill material for insulating attics and wall cavities. It is also available in batts and blankets or in a spray-in-place form for use as roof underdeck insulation.

As a loose fill material the applied density of cellulose is in the range of 2.2 to 3.0 lb/ft³ when used in attic rafter assemblies and somewhat higher in wall cavities. For these densities the accepted range of thermal resistance values is between 3.7 to 3.2 ft²hr°F/BTU per inch of thickness. If cellulosic insulation is applied at densities significantly less than those specified in the manufacturer's instructions, the material will gradually tend to settle up to 20 percent due to thermal cycling, vibration and moisture. This causes both a reduction in thickness and an increase in the insulation conductivity. However, when the material is applied in strict accordance with the manufacturer's instructions, settling should not be a problem.

When tested according to ASTM C739-73 cellulose should have a weight gain from water absorption not exceeding 15 percent. Loose fill cellulosic insulation has a high water vapor permeability and is hygroscopic.

Cellulose is a naturally combustible material which usually has large amounts (up to 25 percent by weight) of flame retardant chemicals added to meet the specifications for a Class I material. These additives, primarily boric acid, aluminum sulfate, ammonium sulfate and calcium sulfate, may accelerate the corrosion of steel, aluminum and copper.

Currently, all cellulosic insulations sold within the United States are required by the Consumer Product Safety Commission to meet the federal specification HHI-515D. This regulation will require greater material uniformity and insure a high quality product from the cellulose manufacturers.

Table 3.1.2. Cellulose

<u>Material Property</u>	<u>Value</u>	<u>Test Method</u>
Density	2.2 - 3.0 lb/ft ³	
Thermal Conductivity (k factor) at 75°F	0.27 - 0.31 BTU-in/hrft ² °F	ASTM C177, C518
Thermal Resistance (R-value) per inch at 75°F	3.7 - 3.2 hrft ² °F/BTU	
Constant Pressure Specific Heat at 75°F	0.33 BTU/hr°F	
Water Vapor Permeability	High	
Water Absorption	5-20% by weight	ASTM C-739
Capillarity	Not known	
Fire Resistance	Combustible	ASTM E136
Flame Spread	15 - 40	ASTM E-84
Fuel Contributed	0 - 40	ASTM E-84
Smoke Developed	0 - 45	ASTM E-84
Temperature Range	<180°F	
Effects of Age		
Dimensional Stability	May settle 0 - 20%	
Thermal Performance	Reduced with settling	
Fire Resistance	Inconsistent information	
Degradation due to:		
Cycling	May cause settling	
Vermin	Depends on treatment	
Moisture	Reduces thermal performance	
Fungal/Bacterial	May support growth	
Weathering	Do not expose	
Corrosiveness	May corrode steal, Al, Cu	ASTM C-739
Human Factors		
Toxicity	None	ASTM C-739
Sound Absorption	Fair - good	
Specifications:	Federal HH-I-515D ASTM C-739-73	

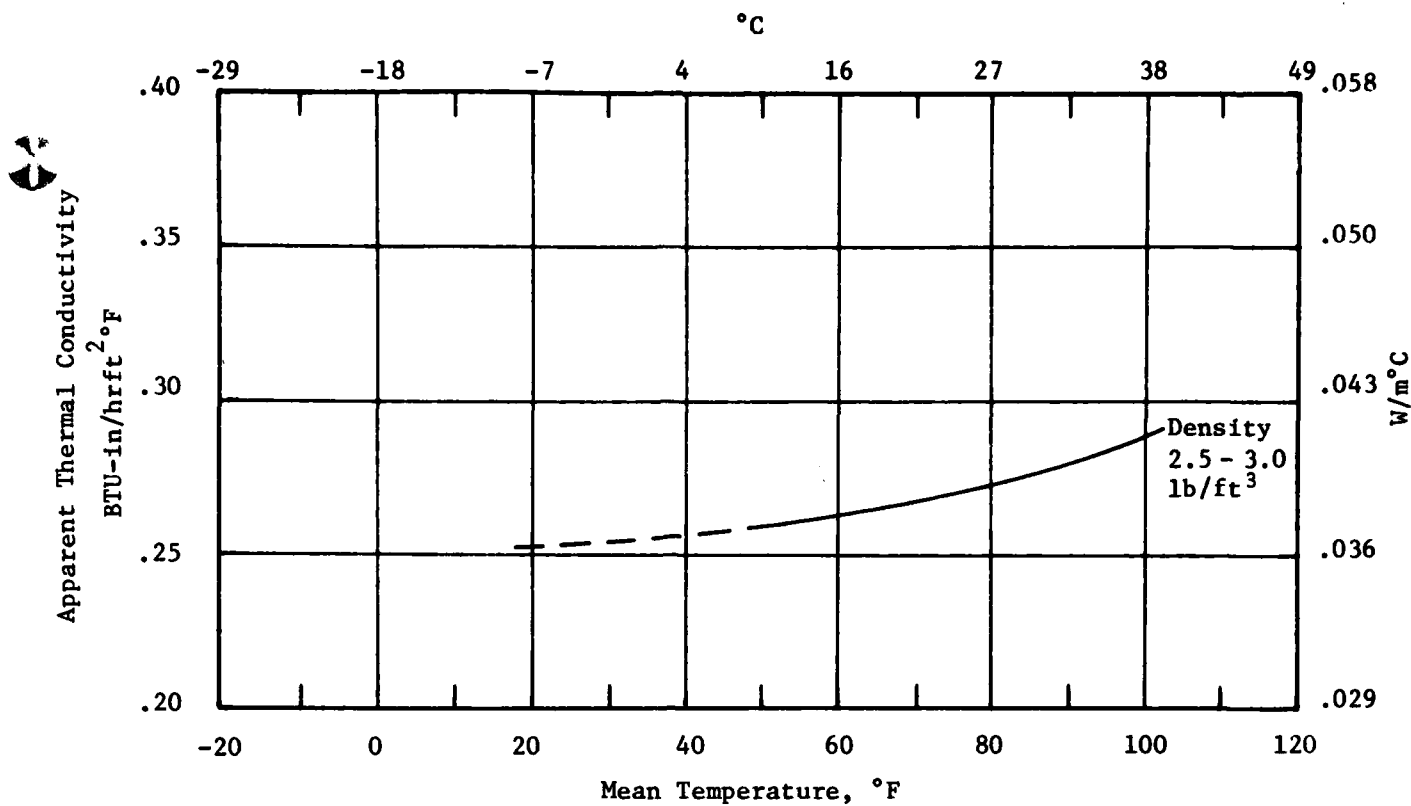
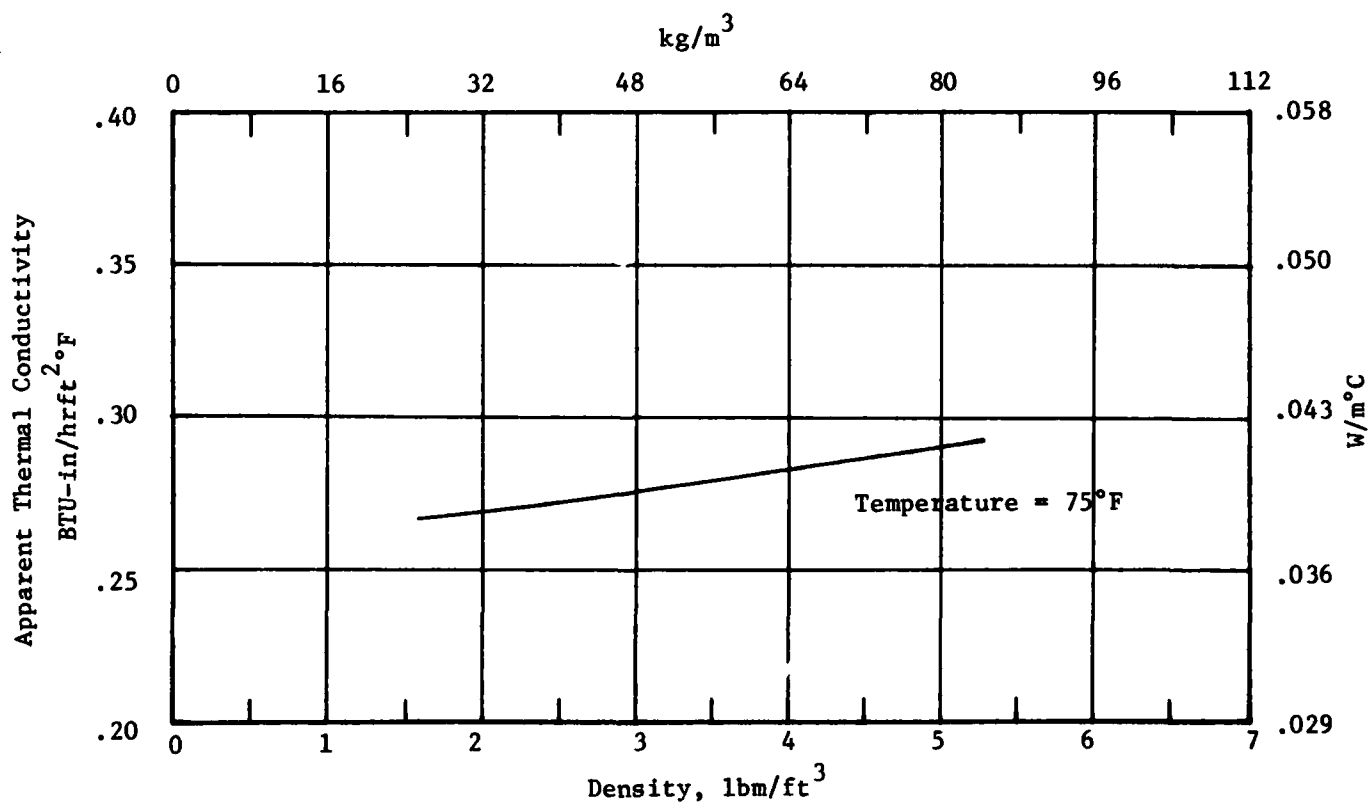


Figure 3.1.2 Cellulose



Source: Refs. 1 and 4.

3.1.3 Fiberglass

Fiberglass insulation is available in batt, board and loose fill form. It is used as thermal and acoustical insulation in residential and commercial/industrial building envelopes for both new and retrofit applications.

Fiberglass batts usually have a density of between 0.6 and 1.0 lb/ft³. Due to the relatively long fibers, it tends to recover to the design thickness after packaging.

When used in the form of batts or blankets fiberglass insulation yields an R-value of about 3.2 per inch of thickness. Loose fill fiberglass is made by hammer milling fiberglass batts and usually provides an R-value of about 2.2 per inch of thickness.

Both loose fill and batt or blanket forms of fiberglass insulation are permable to water vapor to the extent of over 100 perm-inch. Water absorption is typically no more than 1% by weight, by ASTM C553-70, and no capillarity is apparent in these materials.

Fiberglass itself is an inorganic, non-combustible material, but flammable organic binders are used in the production of batts and blowing wool. For the material with binder ASTM E-84 yields the following approximate ratings: flame spread: 15 - 20; fuel contributed: 5 - 15; smoke developed: 0 - 20. Facings on fiberglass building insulation usually consist of an asphalt coated kraft or foil-kraft paper laminate which is a flammable surface. The facing must not be exposed to open flames or temperatures exceeding 180°F. Any burning of facings or organic binders used could produce fumes which are hazardous.

Fiberglass batt insulation does not appear to settle or shrink with age, but loose fill may settle if applied at densities below the manufacturer's specifications. Other properties of the material, such as thermal performance and resistance to fire, are reportedly unaffected by age and temperature cycling at normal installed temperatures. Fiberglass does not promote bacterial or fungal growth, and provides no sustenance to vermin. Insulation products made from fiberglass are non-corrosive (Federal Spec. HH-I-558D) and have no objectionable odor (ASTM C-553 - Section 16).

Fiberglass board is manufactured by several companies. The properties of the board are dependent on the material of the substrate and the percentage of fiberglass present. A typical R value might be of the order of 4 hr-ft²/°F/BTU.

Table 3.1.3

FIBER GLASS

<u>Material Property</u>	<u>Value</u>	<u>Test Method</u>
Density	0.6 - 1.0 lb/ft ³	
Thermal Conductivity (K-factor)	0.31 BTU/hrft ² °F (batt)	
Thermal Resistance (R-value) per inch at 75°F	3.2 hrft ² °F/BTU (batt) 2.2 hrft ² °F/BTU (loose fill)	ASTM C-518 ASTM C-653
Constant Pressure Specific Heat at 75°F	0.23 BTU/lbm°F (batt) 0.19 BTU/lbm°F (board)	
Capillarity	None	
Fire Resistance	Non-combustible	ASTM E-136
Flame Spread	15 - 20	ASTM E-84
Fuel Contributed	5 - 15	ASTM E-84
Smoke Developed	0 - 20	ASTM E-84
Temperature Range	<200	
Effects of Age		
Dimensional Stability	Batt - none Loose fill - settling	
Thermal Performance	None	
Fire Resistance	None	
Degradation due to:		
Cycling	None	
Vermin	None	
Moisture	Transient	
Fungal/Bacterial	None	
Weathering	None	
Corrosiveness	None	Federal HH-I-558D
Human Factors		
Toxicity	Non-toxic - fibers may irritate skin	
Odor	None	ASTM C-553 - Sec. 1b
Sound Absorption	Good at high densities or in board form	
Specifications:	Federal HH-I-521E ASTM C-262-64 (76) ASTM C-533-70	

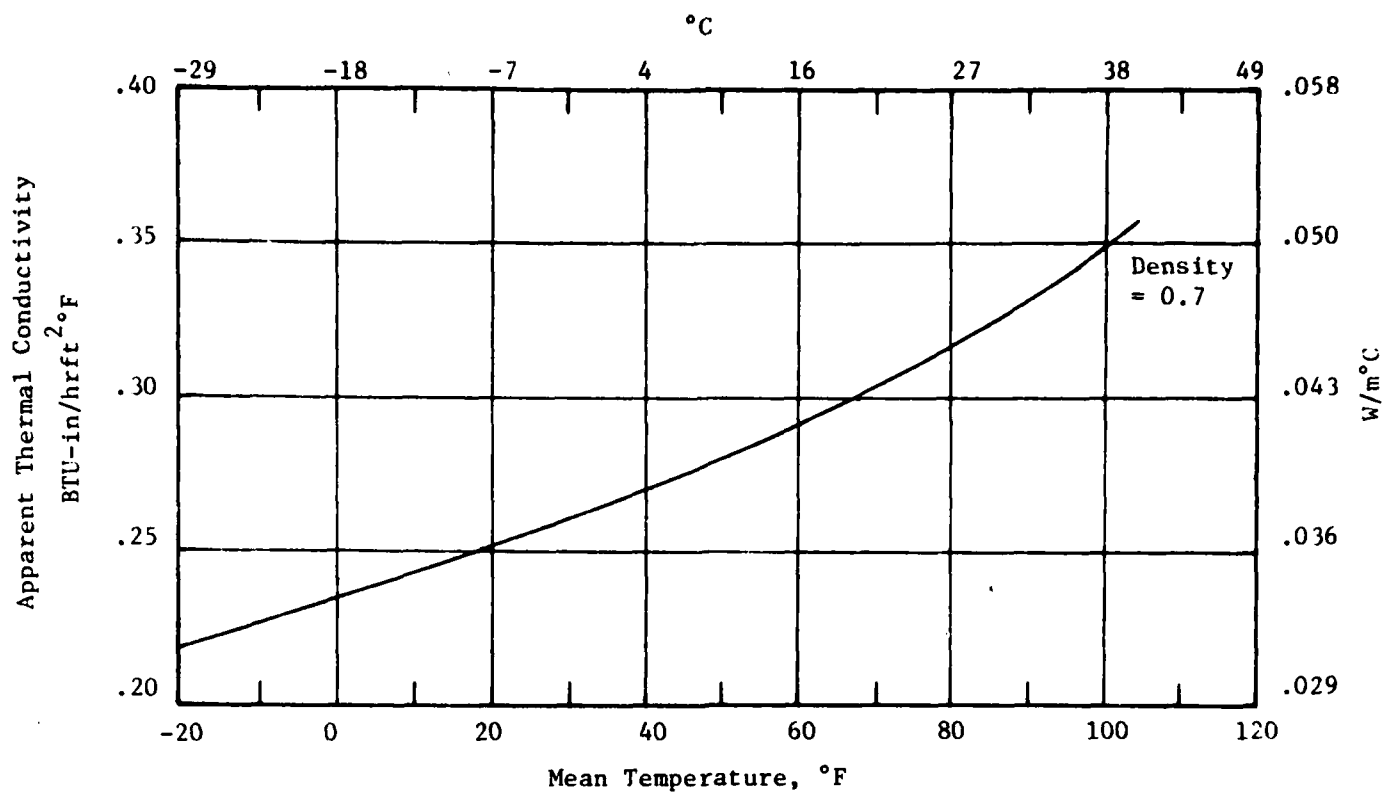
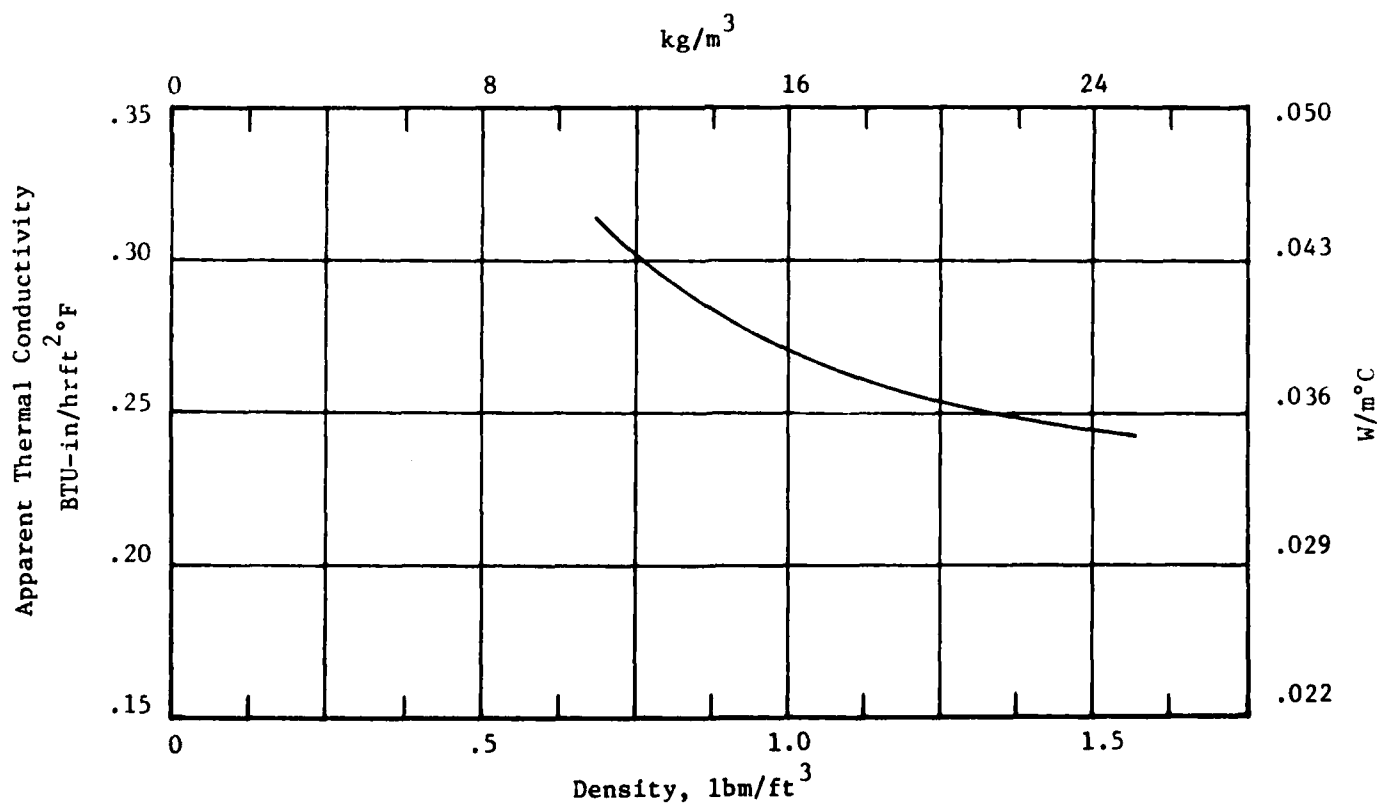


Figure 3.1.3 Fiberglass: Batts and Blankets



Source: Reference 3

3.1.4 Mineral Fiber

Rock or slag wool mineral fiber or mineral wool insulation is produced in a manner similar to that of fiberglass. In the U.S.A. the material most commonly used to manufacture mineral wool is slag - from the production of steel, copper or lead.

Rock wool and fiberglass are similar forms of insulation. They are often used for the same applications in residential/commercial and industrial buildings (see Section 3.3).

The fibers are sprayed with a phenolic resin, which serves as a binder and sometimes with mineral oil which is an additive for sealing the fibers against dust production and moisture.

Rock wool batts and blowing wool are produced with densities in the range of 1.5 to 2.5 lb/ft³, and reported unit thermal resistances (R values) of 3.2 to 3.7 hrft²/BTU per inch of thickness at 75°F (k factor 0.31 to 0.27 BTU-in/hrft²/F) for batts, and 2.9 at 75°F (k factor 0.34) for blowing wool. Water vapor permeability is reported to be >100 perm-in, and water adsorption up to 2% by weight. Rock wool exhibits little or no capillary action.

Made from rock or slag, and melting above 1200°C, the base material is non-combustible, but binders added to the wool may be flammable. Flame spread is reported to be less than 25 (by ASTM-84). Asphalt coated or foil-laminated kraft paper may be used as a vapor retardant facing on batts, and should be considered flammable. Burning of facings or organic binders could produce toxic vapors.

Properties such as dimensional stability, thermal performance, and fire resistance are reportedly unaffected by age, temperature cycling, or weathering. Since rock or slag wool does not have the resiliency of glass it may not recover to the design thickness after packaging, thus resulting in lower than design R values. Thermal conductivity is affected by moisture content, but the change is transient and the material returns to its original properties upon drying. Rock wool does not support the growth of fungus, bacteria, or vermin, exudes no odor and is non-corrosive. The thermal properties of the material are affected by "shot" content, pieces of slag that spun off as particles rather than fibers. Higher apparent thermal conductivity with density increase is due to high shot content.

Table 3.1.4

MINERAL FIBER

<u>Material Property</u>	<u>Value</u>	<u>Test Method</u>
Density	1.5 - 2.5 pcf	
Thermal Conductivity (k-factor)	0.31 - 0.27 BTU-in/ hrft ² F (batts)	ASTM C-177
	0.34 BTU-in/hrft ² F (loose fill)	ASTM C-177
Thermal Resistance (R-value) per inch at 75°F	3.2 - 3.7 hrft ² F/ BTU (batts)	ASTM C-177
	2.9 hrft ² F/BTU (loose fill)	ASTM C-177
Constant Pressure Specific Heat at 75°F	0.18 BTU/lbm°F	
Water Vapor Permeability	100 perm-in	
Water Absorption	2% by weight	
Capillarity	None	
Fire Resistance	Non-combustible	ASTM E-136
Flame Spread	15	ASTM E-84
Fuel Contributed	0	ASTM E-84
Smoke Developed	0	ASTM E-84
Temperature	<200°F	
Effects of Age		
Dimensional Stability	Batt - none Loose Fill - may settle	
Thermal Performance	None	
Fire Resistance	None	
Degradation due to:		
Cycling	None	
Vermin	None	
Moisture	Transient	
Fungal/Bacterial	None	
Weathering	None	
Corrosiveness	None	
Human Factors		
Toxicity	Non-toxic - fibers may irritate skin	
Odor	None	
Sound Absorption	Good at high densities	

Specifications: Federal HH-I-521E
ASTM C-262-64 (76)
ASTM C-553-70

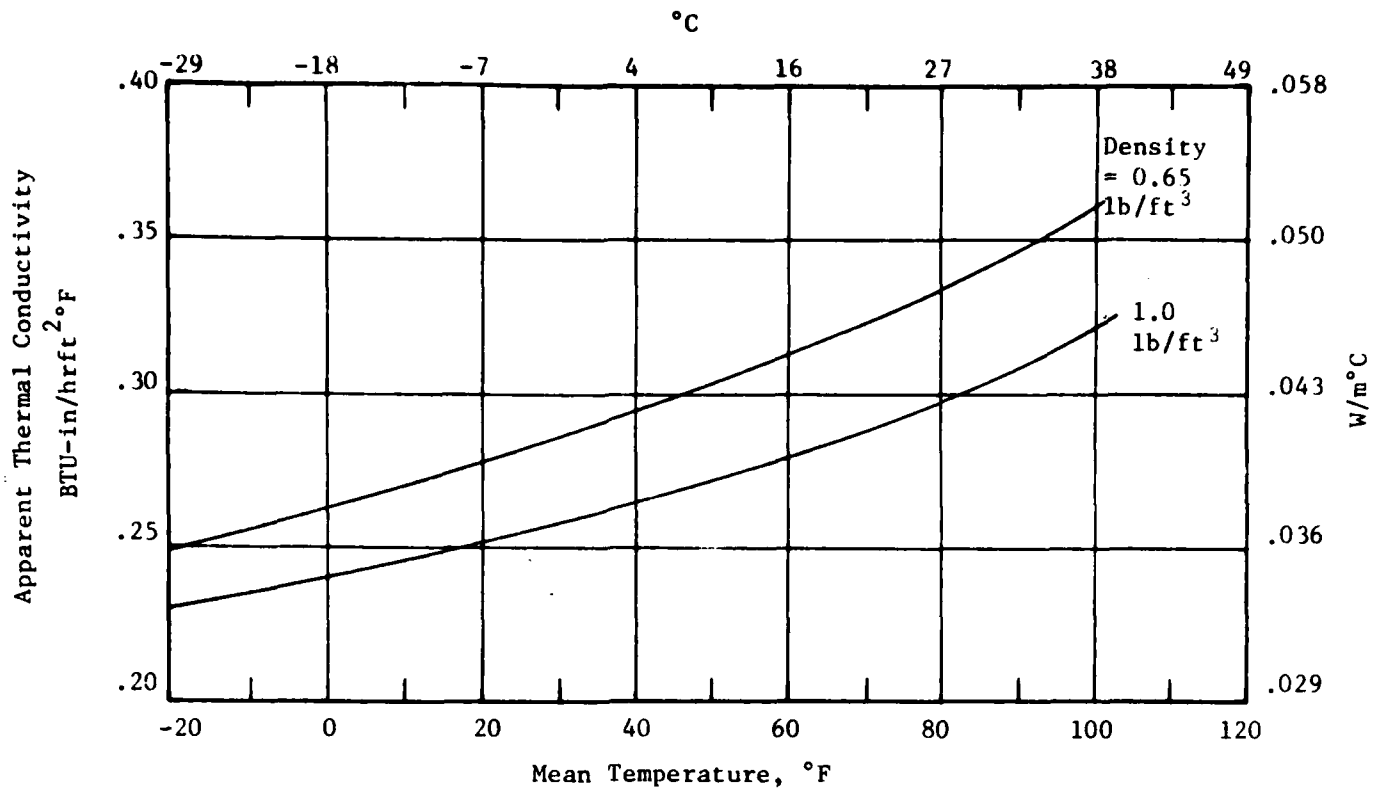
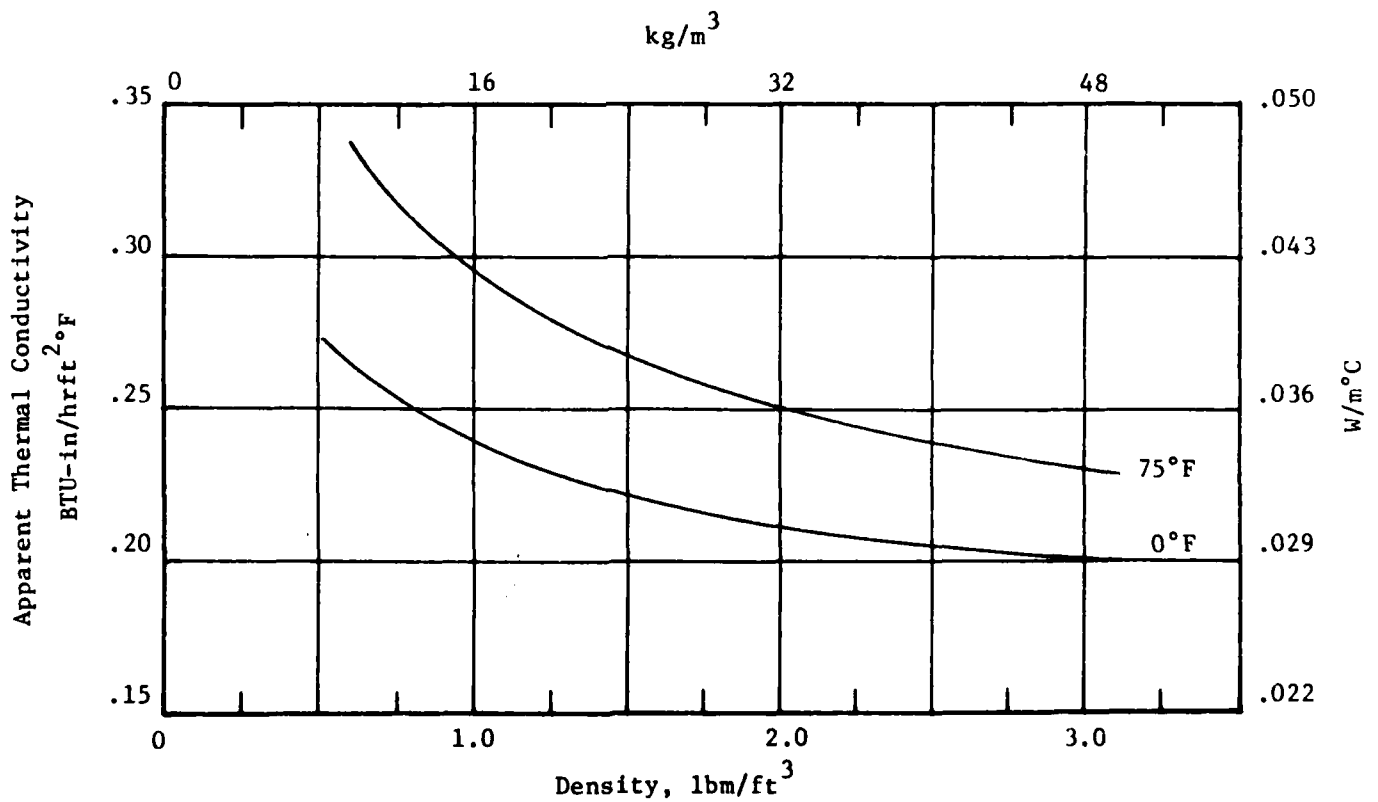


Figure 3.1.4 Mineral Fiber: Batts and Blankets



Source: Reference 1

3.1.5 Perlite

Perlite loose fill insulation is made from silicious volcanic glass pellets, expanded to between 4 and 20 times this original volume. These pellets contain glass enclosed dead air spaces. Expanded perlite can be produced with densities between 2 and 11 lb/ft³.

Perlite is used primarily in industrial/commercial buildings as a roof insulation board material. The next largest use is in lightweight insulating concrete. Perlite insulating concrete, both preformed and cast-in-place, is used primarily for roof decks, floor slabs, and wall systems. Low density expanded perlite is used as a loose fill insulation.

The thermal conductivity of loose fill perlite insulation is dependent on the applied density. The conductivity ranges from 0.27 BTU-in/ft²hr°F at a density of 2 lbs/ft³ to 0.40 BTU-in/ft² at 11 lbs/ft³. Perlite boardstock is available with a conductivity of 0.36 - 0.38 BTU-in/ft²hr°F at a density of about 10 lb/ft³.

Usually a non-flammable silicone treatment is used to increase its resistance to water penetration and perlite is claimed to be water repellent and impervious to moisture. Being inorganic, perlite is rot, vermin, and termite resistant and is non-combustible. It softens at temperatures between 890°C and 1100°C, and melts between 1280°C and 1350°C.

Expanded perlite is mixed with Portland Cement to form a lightweight insulating concrete. Density is varied by controlling the perlite/cement ratio, and a range of 20 to 40 lb/ft³ is typical. Perlite concrete, which may be precast in a number of shapes or cast-in-place, possesses sufficient mechanical strength to be load-bearing at high densities. It has a k-factor of 0.51 to 2.00 BTU-in/hr ft²°F, k increasing with increasing density.

Table 3.1.5

PERLITE

Material Property	Value		Test Method
	Loose Fill	Perlite Concrete	
Density	2 - 11 lb/ft ³	20 - 40 lb/ft ³	
Thermal Conductivity (k-factor) at 75°F	0.27 - 0.40 BTU-in/hrft ² °F	0.50 - 0.93 BTU-in/hrft ² °F	ASTM C-177
Thermal Resistance (R-value) per 1" thickness at 75°F	3.7 - 2.5 hrft ² °F/BTU	2.0 - 1.08 hrft ² °F/BTU	
Constant Pressure Specific Heat at 75°F	0.26 BTU/lbm°F	0.32 BTU/lbm°F	
Water Vapor Permeability	High	High	
Water Absorption	Low		
Capillarity	Medium		
Fire Resistance	Non-combustible	Non-combustible	ASTM E-136
Flame Spread	0	0	ASTM E-84
Fuel Contributed	0	0	ASTM E-84
Smoke Developed	0	0	ASTM E-84
Temperature Range	< 1200°F	< 500°F	
Effect of Age			
Dimensional Stability	None	None	
Thermal Performance	None	None	
Fire Resistance	None	None	
Degradation due to:			
Cycling	None	Low densities may show freeze-thaw damage	
Vermin	No food value	No food value	
Moisture	Transient	Transient	
Fungal/Bacterial	Does not promote growth	Does not promote growth	
Weathering	None	None	
Corrosiveness	None	None	
Human Factors			
Toxicity	Not toxic	Not toxic	
Odor	No odor	No odor	
Sound Absorption	Medium - good at high densities	Good	

Specifications: Federal HH-I-574B
ASTM C-549-73

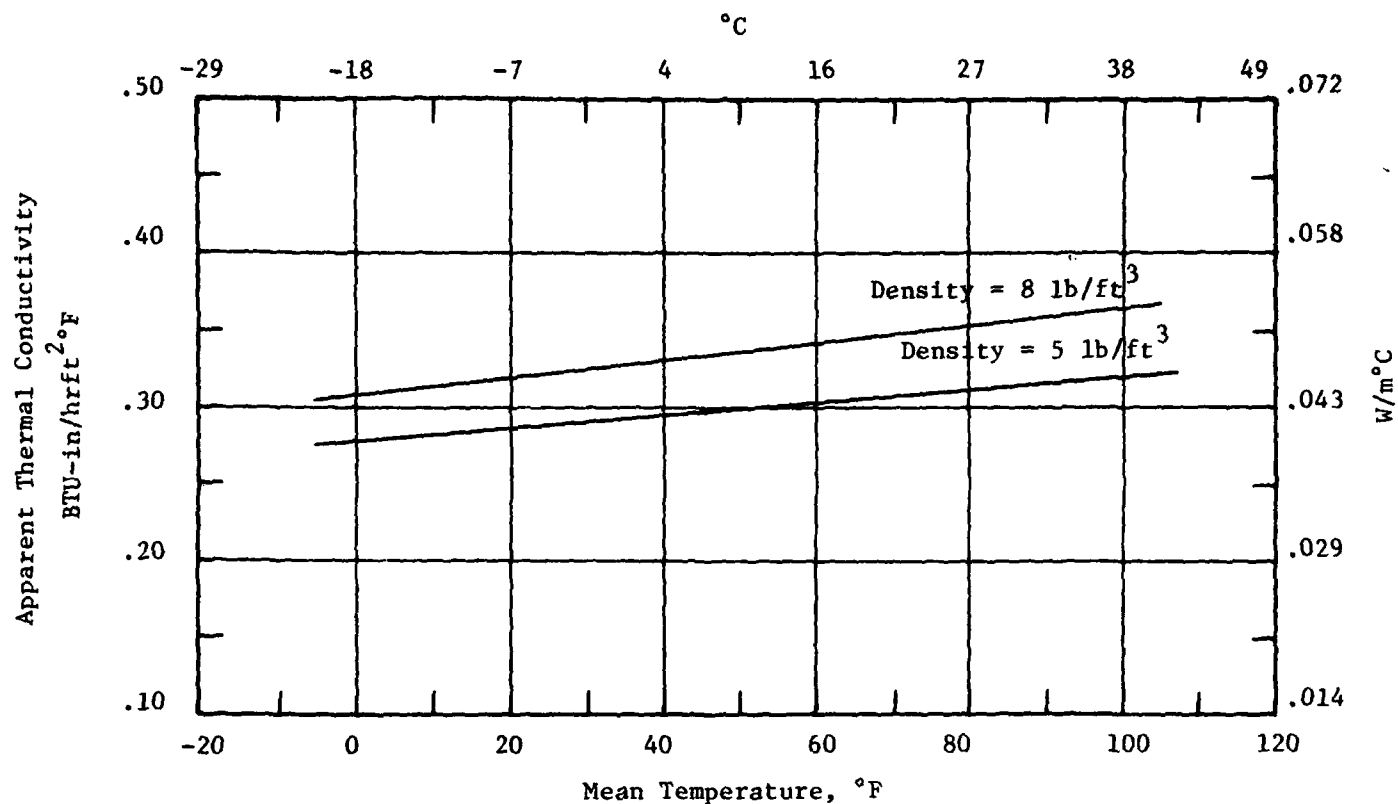
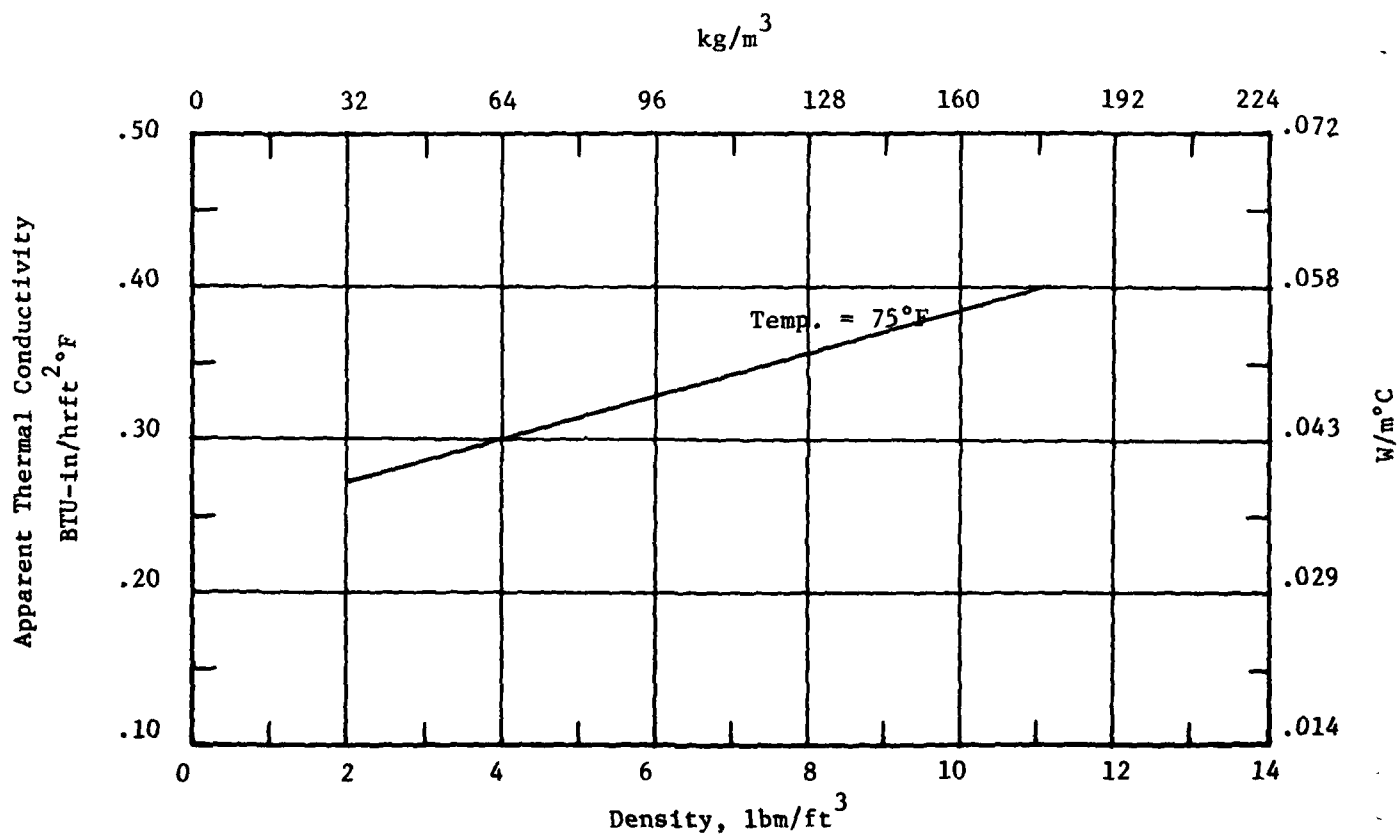


Figure 3.1.5 Perlite



Source: Reference 6.

3.1.6 Polystyrene Foam

Polystyrene foam insulation is manufactured in two forms: extruded, and molded expanded bead.

Foam produced by the extrusion process has a more consistent density, uniform appearance, and greater compressive and tensile strength than that produced by the molding process. Extruded density is usually in the range of 1.8 - 3.0 lb/ft³. The reported "k" factor is 0.12 BTU-in/hrft²°F as manufactured but as the air diffuses in, the "k" factor rises to 0.20 BTU-in/hrft²°F. This value with an equivalent R per inch thickness of 5 hrft²°F/BTU is normally accepted for this material in use.

Extruded polystyrene shows a permeability to water vapor of 0.6 perm-in when tested by ASTM-C355-64 and a volumetric water absorptance of 0.7% (21.8% by weight) by ASTM-C2842-69. There is no apparent capillary action by polystyrene.

Molded polystyrene is made to have densities in the range of 0.8 to 1.8 lb/ft³. Variations of about 10% from the average density can be found in a piece of molded polystyrene due to the molding process. Thermal conductivity of this material is directly proportional to density, and is usually in the range of 0.23 to 0.26 BTU-in/hrft²°F. This value does not change with age. The R-value for molded polystyrene is lower than the R-value for extruded polystyrene since the former has air in the cells while the latter has a mixture of air and fluorocarbon. Water vapor permeability for the molded material is reported to be 1.2 to 3.0 perm-in by ASTM-C355, and water absorption less than 2% by weight by ASTM-C272.

Polystyrene foam insulating boards and sheathing are used in residential, commercial and industrial applications as shown in Section 3.3. When used as an external sheathing material the entire area of the building envelope may be insulated, thus reducing the heat loss through the more conductive structural members. Plastic foam sheathings provide a barrier to air infiltration superior to conventional sheathings, but they are non-structural materials with low nail holding capabilities.

Other properties of polystyrene insulation are independent of the manufacturing process. Polystyrene is combustible, and in use must be covered with a flame resistant covering such as gypsum board. It must also be protected from direct exposure to ultraviolet light, which causes dusting, and yellowing. Insulating properties, however, are not affected by short-term exposure to UV light. The maximum service temperature of polystyrene is 165°F; exposure to higher temperatures will cause the plastic to soften. There is no effect (survey responses) of cycling or weathering on the insulation in the service temperature range. Polystyrene does not promote the growth of fungus or bacteria, and contains nothing of food value for animals. This insulation has no odor, and is non-corrosive.

Table 3.1.6

EXPANDED POLYSTYRENE

<u>Material Property</u>	<u>Extruded*</u>	<u>Molded</u>	<u>Test Method</u>
Density	1.8 - 3.0 lb/ft ³	0.8 - 2.0 lb/ft ³	
Thermal Conductivity (k-factor)	0.20 BTU-in/hrft ² °F	0.23 - 0.26 BTU-in/hrft ² °F	ASTM C-177, C-518
Thermal Resistance (R-value) per inch at 75°F	5 hrft ² °F/BTU	3.85 - 4.35 hrft ² °F/BTU	
Constant Pressure Specific Heat at 75°F	0.27 BTU/lbm°F	0.29 BTU/lbm°F	
Water Vapor Permeability	0.6 perm-in	1.2 - 3.0 perm-in	ASTM C-355
Water Absorption	None	None	
Capillarity	None	None	ASTM E-136
Fire Resistance		Combustible	
Flame Spread	25	5 - 25	ASTM E-84
Fuel Contributed	-	5 - 80	ASTM E-84
Smoke Developed	-	10 - 400	ASTM E-84
Temperature Range	< 165°F	< 165°F	
Effects of Age			
Dimensional Stability	None	None	
Thermal Performance	-	None	
Fire Resistance	None	None	
Degradation due to:			
Cycling	None	None	
Vermin	None	None	
Moisture	None	None	
Fungal/Bacterial	None	None	
Weathering	U.V. degrades surface	U.V. degrades surface	
Corrosiveness	None	None	
Human Factors			
Toxicity	-	-	
Odor	None	None	
Sound Absorption	Medium	Medium	

Specifications: Federal HH-I-524B
ASTM C578-69

* From Dow Chemical Literature.

Apparent Thermal Conductivity

BTU-in/hrft²°F

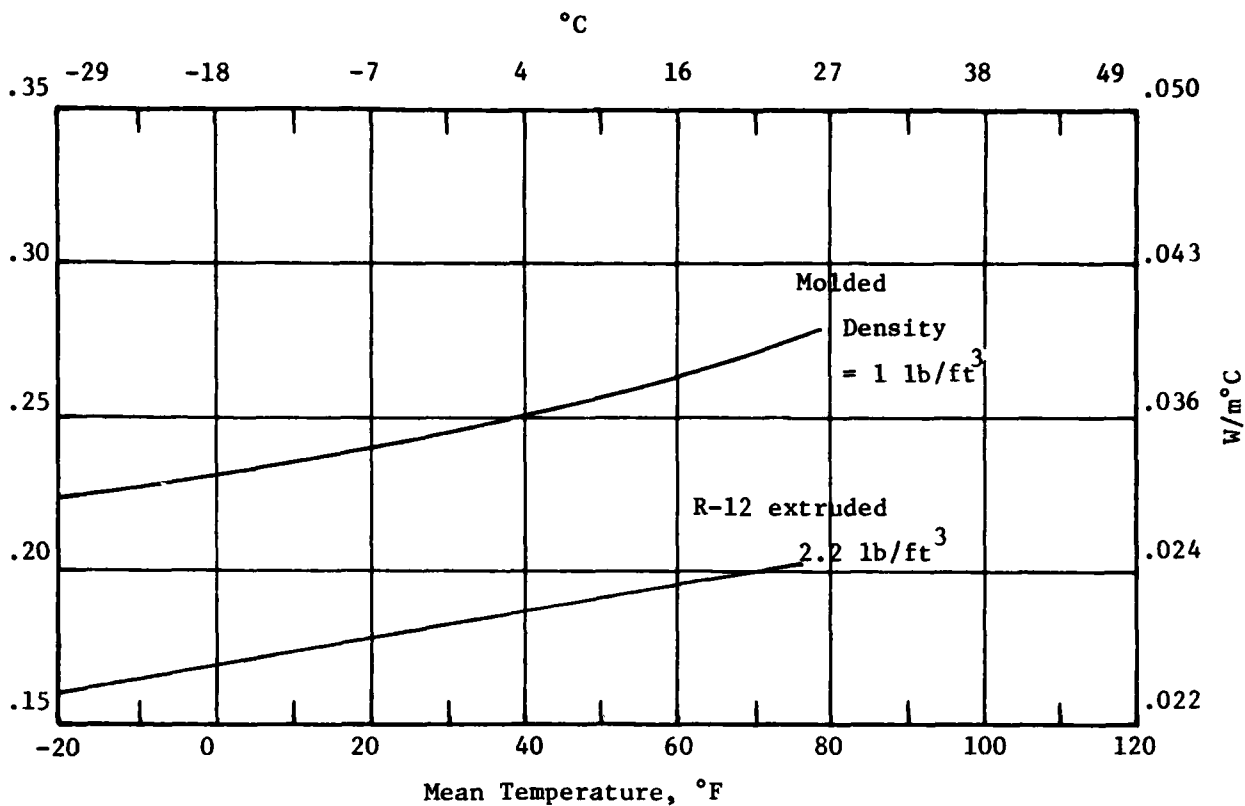
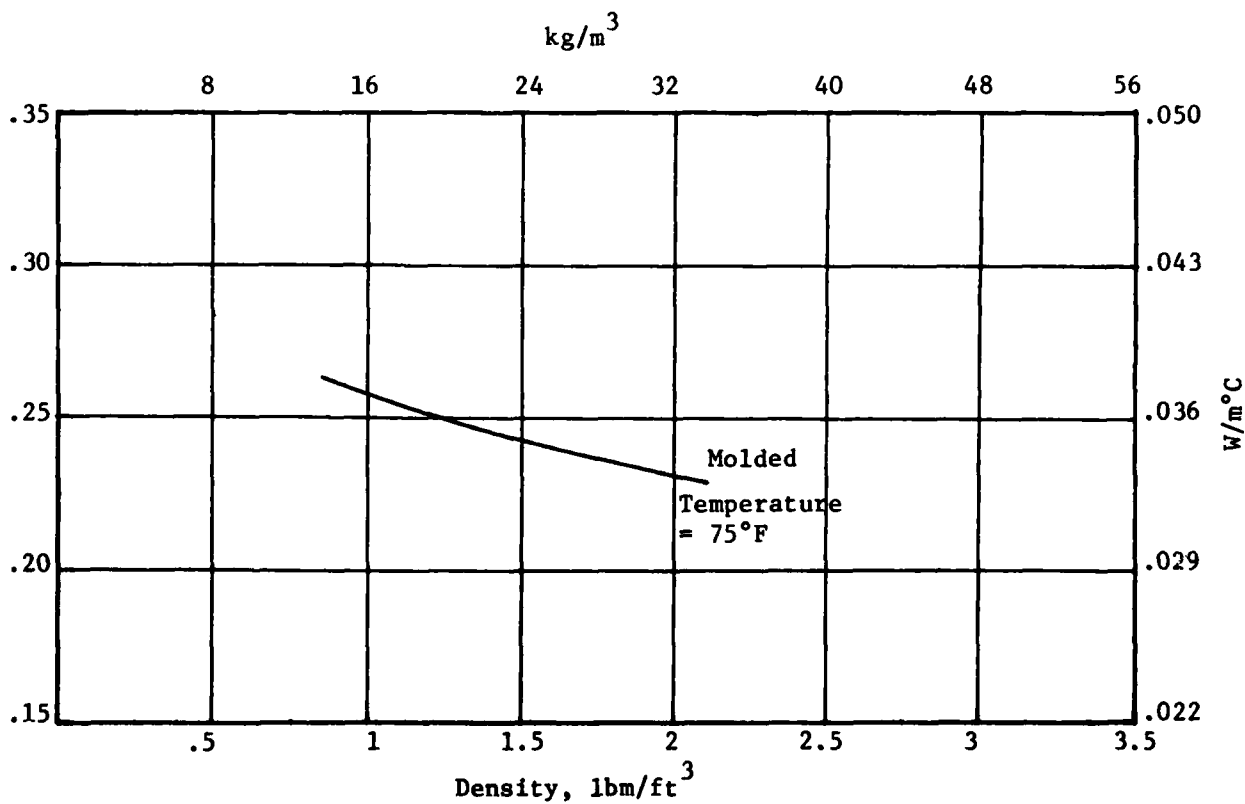


Figure 3.1.6 Polystyrene

Apparent Thermal Conductivity

BTU-in/hrft²°F



Source: References 1 and 5.

3.1.7 Polyurethane/Polyisocyanurate Foam

Polyurethane and polyisocyanurate foams are flourocarbon-blown materials which possess a rigid structure upon curing. These foams are available as precast boardstock, with or without felt surfacing, and as either foamed in place or sprayed in place insulation.

These materials have a thermal conductivity (k factor) of 0.11 to 0.15 BTU-in/ft hr°F at 75°F when new, and a density of 2.0 lb/ft³. The sprayed in place foam is readily available in densities of 2.0 to 3.0 lb/ft³. The closed cell content of these rigid foams is approximately 90 percent. The fluorocarbon gas within the cells has a significantly lower thermal conductivity than air, which explains the low "k" factor of the material.

It is known that "as manufactured" foam will have values of 0.11 to 0.12 BTU-in/hrft²°F, but that the thermal conductivity will increase as the foam ages as air diffuses into the cells. This process is reduced or eliminated when a relatively air tight facing is used on the foam. The ASTM Standard Specification for Rigid Preformed Cellular Urethane Thermal Insulation C-591-69, shows values of 0.16 to 0.17 for material aged over 300 days with an initial value of 0.11 to 0.12 BTU-in/hrft²°F. Rigid polyurethane and polyisocyanurate foams are used primarily for commercial/industrial buildings as roof insulation, floor and foundation insulation, cavity wall insulation, and interior and exterior spray-on wall insulation. These foams are also used in residential construction, principally as sheathing.

Polyurethane and polyisocyanurate foams show dimensional change upon curing and aging. The degree of expansion or shrinkage is related to conditions of temperature and humidity and the duration of exposure to extreme conditions. For polyurethane, results of ASTM-D-2126 Procedure F (160°F and 100% RH) indicate a change in volume of up to 12% after 14 days. For polyisocyanurate, results with this same test indicate a 3% change in volume after 14 days. Because of the high closed cell content, water absorption and permeability are very low; permeability is typically 2 to 3 perm-in. Polyurethane and polyisocyanurate foams are resistant to fungal and bacterial growth.

Polyurethane and polyisocyanurate foams are flammable and must be covered with a fire retardant material when used for thermal insulation in most applications. Certain polyisocyanurate foams have been approved for exposed use in certain industrial/commercial buildings. Typical burning characteristics for polyurethane are a flame spread of 25 - 75, fuel contributed value of 10 - 25, and smoke developed of 155 to over 500. For polyisocyanurate, the flame spread is less than 25, fuel contributed is less than 5, and smoke developed is 55 - 200. Most compositions of these foams begin to decompose above 250°F.

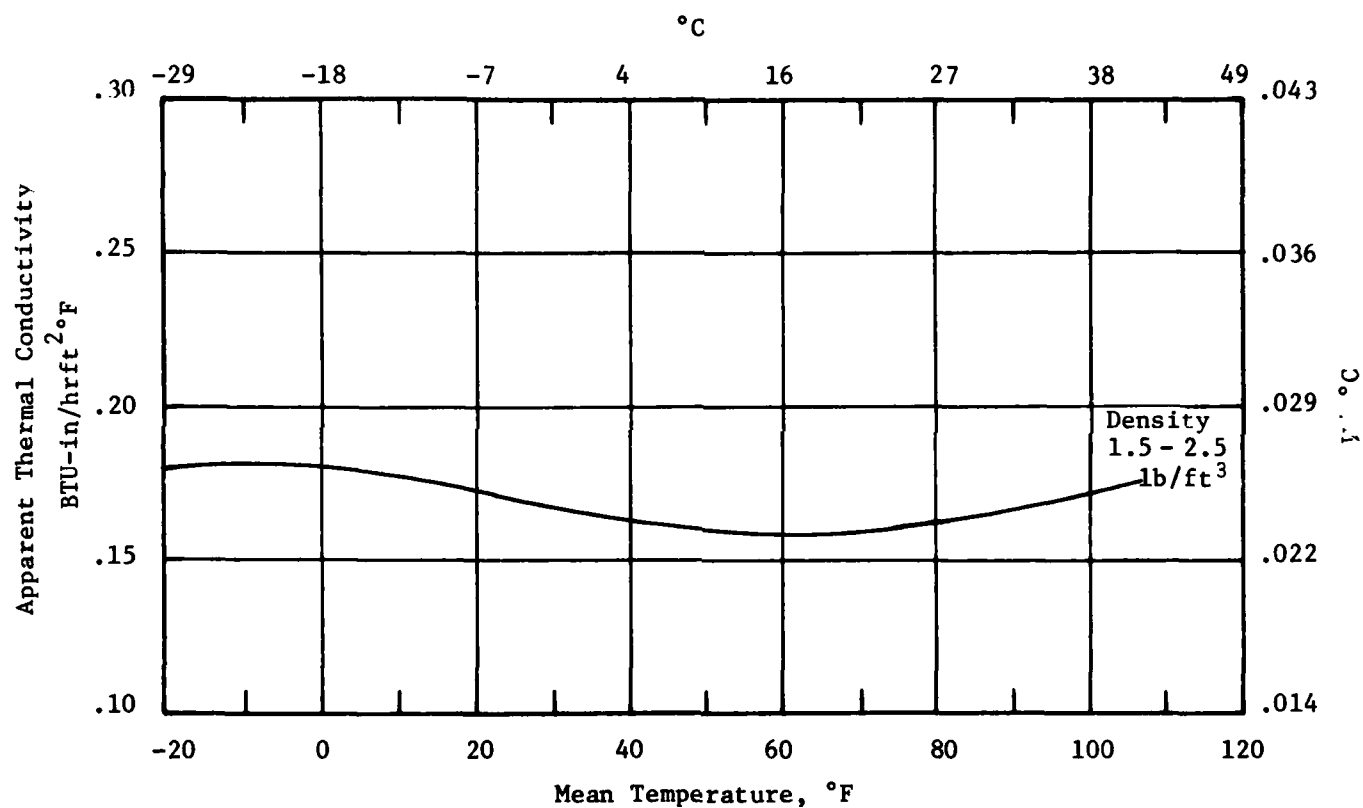
Polyurethane or polyisocyanurate board stock can be used as frame sheathing in building construction to providing insulation over the whole building frame, thus minimizing the effect of the more conductive structural members. A major manufacturer of polyisocyanurate foam sheathing specifies vent strips to allow escape of water vapor which has penetrated the inner face vapor barrier. This may lessen the benefits of reduced air infiltration.

Table 3.1.7

POLYURETHANE/POLYISOCYANURATE FOAMS

Material Property	Value	Test Method
Density	2.0 - 3.0 lb/ft ³	
Closed Cell Content	90%	ASTM C-591-69
Thermal Conductivity (k factor) at 75°F	0.16 - 0.17 BTU-in/ hrft ² °F (aged and unfaced or spray applied) 0.13 - 0.14 BTU-in/ hrft ² °F (impermeable skin faced)	ASTM C-177, C-518 ASTM C-177, C-518
Thermal Resistance (R-value) Per 1" of thickness at 75°F	6.2 - 5.8 hrft ² °F/BTU (aged and unfaced or (spray applied) 7.7 - 7.1 hrft ² °F/BTU (impermeable skin faced)	
Constant Pressure Specific Heat at 75°F	0.38 BTU/lbm°F	
Water Vapor Permeability	2 - 3 perm-in	
Water Absorption	Negligible	
Capillarity	None	
Fire Resistance	Combustible	ASTM E-136
Flame Spread	25 - 75 polyurethane 25 polyisocyanurate	ASTM E-84
Fuel Contributed	10 - 25 polyurethane 5 polyisocyanurate	ASTM E-84
Smoke Developed	155 - 500 polyurethane 55 - 200 poly- isocyanurate	
Temperature Range	< 250°F	
Effect of Age		
Dimensional Stability	0 - 12% change	ASTM D-2126
Thermal Performance	0.11 new 0.17 aged 300 days	ASTM C591-69
Fire Resistance	None	
Degradation due to:		
Cycling	Not Known	
Vermin	None	
Moisture	Limited information available	
Fungal/Bacterial	Does not promote growth	
Weathering	None	
Corrosiveness	None	
Human Factors		
Toxicity	Produces CO when burned	
Odor	None	
Sound Absorption	Medium	
Specifications:	Federal HH-I-530A ASTM C- 591-69	

Figure 3.1.7
Polyurethane/Polyisocyanurate Foam



Source: Reference 1.

3.1.8 Vermiculite

Vermiculite insulation is made from mica-like hydrated silicate particles which are heated quickly to 700 - 1000°C, causing the occluded water to vaporize and exfoliate the micaceous layers.

By controlling the degree of exfoliation, a density range of, typically, 4 to 10 lb/ft³ is produced in the expanded material. The lower density material has an average particle size of 6.5 mm and is commonly used as loose-fill insulation and concrete aggregate. Higher density material is used as plaster aggregates and for high temperature applications, as particle sizes become smaller (1.5 to 4.5 mm), air voids between particles are smaller and convection is minimized. The thermal conductivity of exfoliated vermiculite is typically 0.33 to 0.41 BTU-in/hrft²°F at ambient temperatures, which translates to R values of 3.0 to 2.4 per inch.

Vermiculite is also mixed with Portland Cement and sometimes sand to produce vermiculite concrete. Densities of this material usually range from 20 to 60 lb/ft³, with higher densities resulting in higher thermal conductivities which range from 0.59 to 0.96 BTU-in/hrft²°F (R of 1.7 to 1.0 per inch).

Vermiculite is treated to ensure water repellency. It is non-combustible and melts at 1315°C. Being an inorganic material, it is resistant to rot, vermin, and termites, and is not affected by age, temperature, or humidity. Vermiculite is chemically inert, and therefore non-corrosive and exudes no odors.

Table 3.1.8

VERMICULITE

Material Property	Value		Test Method
	Loose Fill	Vermiculite Concrete	
Density	4 to 10 lb/ft ³	20 to 60 lb/ft ³	
Thermal Conductivity (k factor) at 75°F	0.33 - 0.41 BTU-in/hrft ² °F	0.59 - 0.96 BTU-in/hrft ² °F	ASTM C-177
Thermal Resistance (R value) per 1" of thickness at 75°F	3.0 - 2.4 hrft ² °F/BTU	1.7 - 1.0 hrft ² °F/BTU	
Constant Pressure Specific Heat at 75°F	0.35 BTU/lbm°F	0.34 lbm°F	
Water Vapor Permeability	High	High	
Water Absorption	None	None	
Capillarity	None	None	
Fire Resistance	Non-combustible	Non-combustible	ASTM E-136
Flame Spread	0	0	ASTM E-84
Fuel Contributed	0	0	ASTM E-84
Smoke Developed	0	0	ASTM E-84
Temperature Range	< 1000°F	< 1000°F	
Effect of Age			
Dimensional Stability	None	None	
Thermal Performance	None	None	
Fire Resistance	None	None	
Degradation Due to:			
Cycling	None	Low densities may show freeze-thaw damage	
Vermin	No food value	No food value	
Moisture	None	None	
Fungal/Bacterial	Does not promote growth	Does not promote growth	
Weathering	None	None	
Corrosiveness	None	None	
Human Factors			
Toxicity	Not toxic	Not toxic	
Odor	No odor	No odor	
Sound Absorption	Medium - good at high densities	Good	
Specifications:	Federal HH-I-586 ASTM C-196-61 (67) ASTM C516-75		

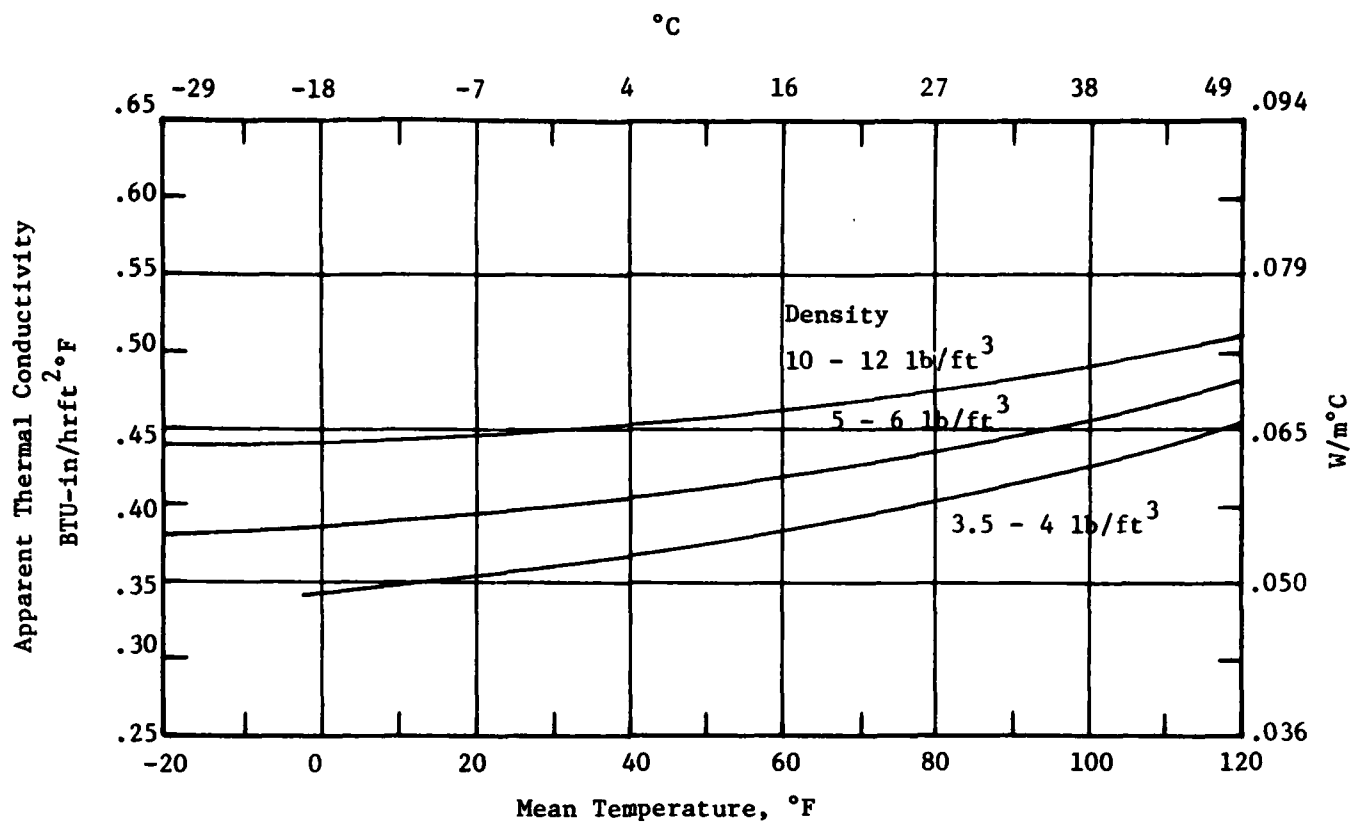
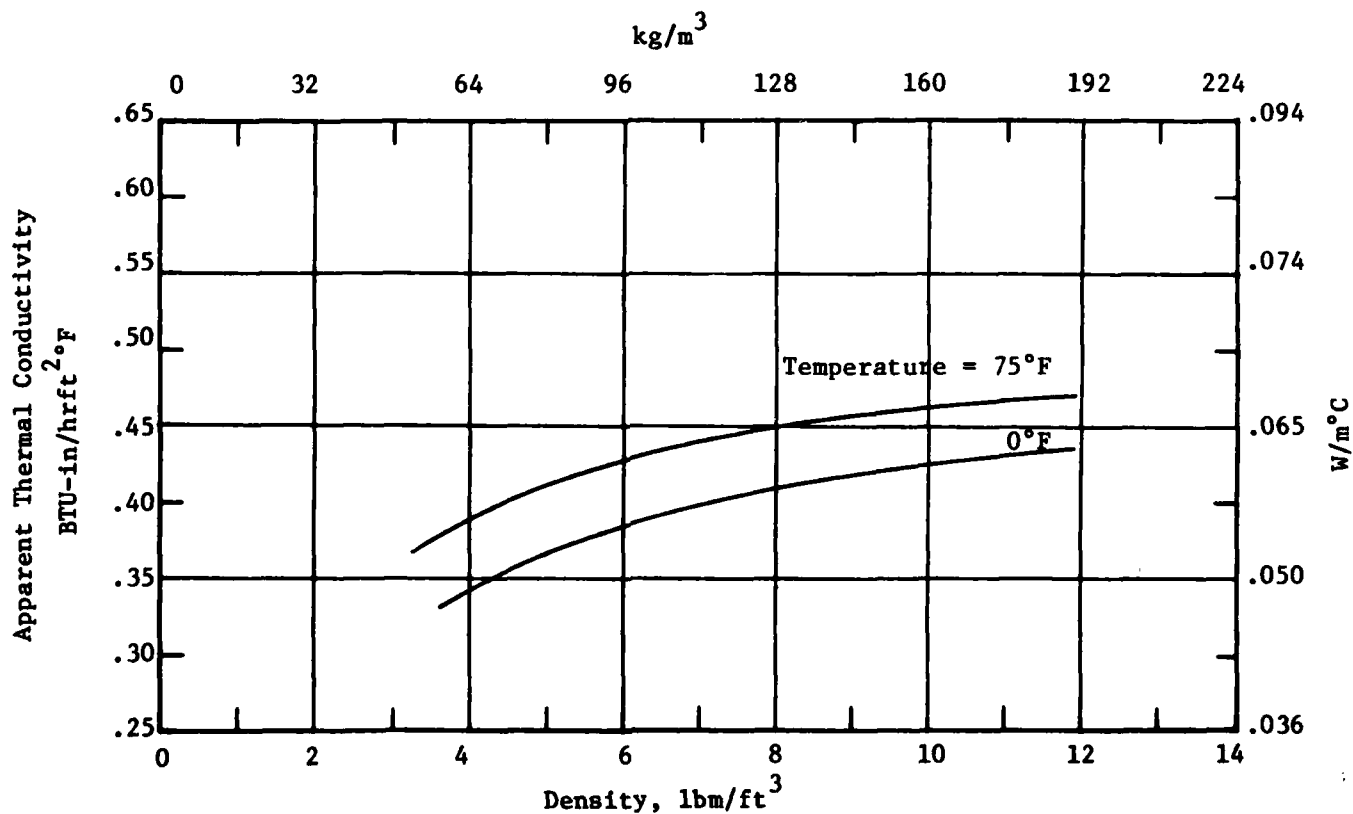


Figure 3.1.8 Vermiculite



Source: Reference 2.

3.1.9 Urea-Based Foams

Urea-formaldehyde foam is generated at the site of application by the combination of an aqueous solution of a urea-formaldehyde based resin, an aqueous solution foaming agent which includes a surfactant, a hardening agent, and air. In the mixing or foaming nozzle compressed air is mixed with the foaming agent to produce small bubbles which are expanded and coated with the urea-formaldehyde resin. The foam is delivered at about 75 percent water by weight. The foam typically cures sufficiently to be self-supporting in less than 1 minute while full chemical curing requires several weeks. The rate of water dry-out from the foam depends on the type of structure in which the foam is applied. The foam produced in this manner consists of an approximately 70 - 80 percent closed-cell structure. Recently urea-formaldehyde foam has become available as a pre-cured loose fill material.

The quality of installation of U-F foams is critical to its acceptability as an insulation. Improper installation can lead to excessive shrinkage and lingering formaldehyde vapors within the structure. In some cases where poor installation practices were used, the dwelling had been unsuitable for living several weeks after the installation.

Urea-based foam insulation has been considered a generic material. However, it is known that differences exist in the composition and properties of the foams available in the United States. The specific formulations used by the industry are proprietary and include chemical components for the purpose of improving foam properties. Also, different types of apparatus are used to produce the foam.

From basic considerations of general behavior, European experiences, and measurements both at NBS and NRC in Canada, an R value of $4.2 \text{ hrft}^2 \text{ } ^\circ\text{F}/\text{BTU-in}$ is recommended as a reliable value at the density of use, 0.7 to 0.8 lb/ft³.

The major application of urea-formaldehyde and urea-based foam as a thermal insulation is for retrofitting residential wall cavities. It is also used, but to a lesser extent, as an insulation in commercial/industrial buildings for both new construction and retrofit and in residential new construction.

Urea-formaldehyde foams usually show a linear shrinkage of between 0.8 and 4% upon curing. The NBS has reported preliminary test results showing significantly greater shrinkage when exposed to high temperature and high humidity environments. HUD specifications recommend derating the claimed R-values by 28% for design purposes to account for the higher conductivity of the air spaces created when the insulation contracts.

New formulations are being developed which are claimed to reduce the shrinkage problem.

Urea-formaldehyde foam is a combustible material, however it is usually less flammable than other plastic foams. The degree of resistance to fire will vary depending on the particular formulation. Typical ranges for the fire resistance indexes are: flame spread 0 to 25, fuel contributed 0 to 30 and smoke developed 0 - 70.

Table 3.1.9

UREA-FORMALDEHYDE AND UREA-BASED FOAMS

Material Property	Value*	Test Method
Density	Wet - approximately 2.5 lb/ft ³ Dry - 0.6 to 0.9 lb/ft ³	ASTM 1622-63
Closed Cell Content	70 - 80%	
Thermal Conductivity (k factor) at 75°F	0.24 BTU-in/hrft ² °F	ASTM C-177-76
Thermal Resistance (R value) per 1" of thickness at 75°F	4.2 hrft ² °F/BTU	Mean Temp. 75°F
Constant Pressure Specific Heat	Not Available	
Water Vapor Permeability	4.5 to 100 perm-in at 50% rh 73°F	ASTM C-355
Water Absorption	32% by weight (0.35% volume) 95% rh 18% by weight (0.27% volume) 60% rh, 68° 180 - 3800% by weight (2 - 42% volume)immersion	
Capillarity	Slight	
Fire Resistance	Combustible	
Flame Spread	0 - 25	ASTM E-84
Fuel Contributed	0 - 30	ASTM E-84
Smoke Developed	0 - 10	ASTM E-84
Temperature Range	Decomposes at 415°F	
Effect of Age		
Dimensional Stability	1 to 4% shrinkage in 28 days due to curing 4.6 to 10% shrinkage at 100°F, 100% rh for one week 30 to 45% shrinkage at 158°F 90 to 100% rh 10 days	ASTM D-2126 Proc. C ASTM D-2126-66
Thermal Performance	No Change	
Fire Resistance		
Degradation due to:		
Cycling	No damage after 25 freeze-thaw cycles	
Vermin	Not a feed for vermin	
Moisture	Not established	
Fungal/Bacterial	Does not support growth	ASTM G21-70 (1975)
Weathering	Material should not be exposed	
Corrosiveness	None	
Human Factors		
Toxicity	Combustion products less toxic than fumes from burning wood	
Odor	May exude formaldehyde until cured	
Sound Absorption	Medium	

* Taken from Reference 9.

3.1.10 Reflective Surfaces

Reflective materials act as insulation by reflecting incident radiant heat energy, rather than by reducing conduction and convection as bulk insulations do. In a vertical cavity, a wall, for example, about 60% of heat transfer is due to radiation, while in loft and underfloor spaces, radiation contributes about 50% and 70% to heat transfer respectively. Aluminum foil, the most common reflective insulation material, is effective in reducing such losses by 90% when applied to one or both sides of a cavity. However, aluminum foil has relatively little effect on conduction or convection heat losses. Thus, aluminum foil would be of greatest benefit in applications where convective and conductive heat losses are relatively small (such as underfloor spaces).

The reflective insulations consist of a varying number of reflective surfaces enclosing cells of dead air. The thermal resistance of the system is governed by the number of cells and the direction of heat flow. As a system, it performs very effectively in reducing the radiative heat transfer. It does, however, require a reflective air space. The foil itself is non-combustible and an excellent vapor barrier. Aluminum foil insulation has a low mass and heat capacity, so that buildings employing it will heat rapidly, and it takes up minimal space in a wall. Foil is not affected by age or temperature and will not support the growth of fungus, bacteria, or vermin, but the surfaces may be affected by water vapor. If dulling of the reflective surface by oxidation or dusting takes place, the effectiveness will be reduced.

3.1.11 Vapor Barriers

Vapor barriers are included in this report because they are often incorporated into the design of the building's insulation system.

The principal purpose of the vapor barrier is to resist the flow of moisture into the insulating material where it may condense or freeze. Liquid water resulting from condensation has a thermal conductivity some 15 times greater than that of a typical low-temperature insulation. The conductivity of ice is nearly four times that of water; hence, the importance of installing an appropriate vapor barrier should not be underestimated.

The presence of moisture will affect building structural components as well as the insulation thermal performance. The structure of the building may become damaged due to freeze-thaw cycling and rotting of wooden members which are in contact with the condensate.

A vapor barrier should have a water vapor permeance of less than 1 perm (grain/hr·ft² in Hg).

3.2 Comparison of Selected Generic Building Insulation Materials

Table 3.2 summarizes the key characteristics of the various forms of insulation included in this document. The physical properties selected for this include the R and k values and the normal range of applied densities.

The cost of purchasing and installing insulation is often the criterion used to decide between insulations which are otherwise acceptable for a particular job. However, it is impossible to assign a truly representative figure for this quantity due to the regional and job specific factors which influence the cost.

The values reported in this section are intended to be representative of a moderate size application within the New England region. A significant degree of variation from these costs may be expected for other areas, although the relative costs between different insulations will be more uniform.

As mentioned in Section 2.3 the manufacturers should be contacted to obtain their current cost data.

A qualitative description of the advantages and disadvantages associated with using each type of insulation is given in summary form. For reference purposes, the pertinent federal or ASTM specifications are listed.

Table 3.2

GENERIC BUILDING INSULATION COMPARISON CHART

Generic Insulation	R per Inch $\frac{\text{hr ft}^2 \text{ } ^\circ\text{F}}{\text{BTU-in}}$	$k_{\text{App.}}$ $\frac{\text{BTU-in}}{\text{hr ft}^2 \text{ } ^\circ\text{F}}$	ρ $\frac{\text{lb}}{\text{ft}^3}$	Approximate Cost Installed† (¢ per R per ft ²)	Advantages	Disadvantages	Federal Spec. and/or ASTM Standard
BATTS & BLANKETS							
Fiber Glass (3)	3.2	0.32	0.6 - 1.0	3.5 - 4.5	Low Cost, Non-combustible without facings, stable.	Facings may be combustible, binders may burn out.	HH-I-52IE C262-64 (76) C553-70
Rock Wool (3)	3.7 - 3.6	0.27 - 0.28	1.5 - 2.5	3.5 - 4.5	Low cost, Non-combustible without facings, stable.	Facings may be combustible, binders may burn out.	HH-I-52IE C262-64(76) C553-70
BOARDS							
Cellular Glass (1)	2.63	0.38	8.5	*10.0 - 12.0	High compressive strength, Non-combustible, impermeable to moisture, stable.	High cost, low R per inch, Possible freeze-thaw damage when in contact with water.	HH-I-55IE C552
Mineral Fiber with Binder (2, 3)	3.45	0.29	15	5.0 - 7.0	Provides structural support, fire resistant, stable.	Moderate cost. Modest R per inch. Binder may be combustible.	HH-I-55B C612-70 C726-72
Polyurethane & polyisocyanurate foam (3)	unfaced: 6.2 - 5.8 Impermeable skin faced: 7.7 - 7.1	unfaced: 0.16 - 0.17 Impermeable skin faced: 0.13 - 0.14	2.0	3.0 - 6.0	High R per inch, may provide infiltration seal, low moisture absorption, stable.	Moderate cost, combustible (Polyisocyanurate is less so than polyurethane), Nonstructural.	HH-I-530A C591-69
Fiber Glass	4.25	0.24	3.0	*8.0 - 13.0	Good R per inch, low combustibility, good acoustical absorption, stable.	High cost, binders may burn out.	MIL-I-742
Expanded Polystyrene Foam (3)	extruded: 5.0 molded: 3.9 - 4.4	extruded: 0.20 Molded: 0.23 - 0.26	0.8 - 3.0	3.0 - 5.00	Good R per inch, may provide infiltration seal, low moisture absorption, stable.	Combustible, Nonstructural.	HH-I-524B MIL-P-40619 MIL-P-43110 CE-204 C-578-69
Perlite	2.8	.36	11.0	-	Low combustibility, stable.	Low R per inch.	C-728
Mineral Fiber with Foam (3)	3.7 - 7.3	0.27 - 0.14	Non-homogeneous	4.0 - 6.0	Mineral board acts as a fire barrier to protect foam. Can provide structural support, stable.	Foam is combustible.	
Wood Fiber (3)	2.4 - 2.1	0.42 - 0.47	25 (approx)	4.0 - 0.6	Availability, can provide structural support, stable.	Combustible.	C208-72 C532
Insulating Concrete (2,3)	2.0 - 0.8	0.50 - 1.17	20 - 40	-	Non-combustible, can provide structural support, stable.	Low R per inch.	C196-61

Table 3.2

GENERIC BUILDING INSULATION COMPARISON CHART (Concluded)

Generic Insulation	R per Inch hrft ² /F BTU-in	k _{app.} BTU-in hrft ² /F	$\frac{lb}{ft^3}$	Approximate Cost Installed† (\$ per R per ft ²)	Advantages	Disadvantages	Federal Spec. and/or ASTM Standard
<u>LOOSE FILL</u>							
Cellulose (3)	3.7 - 3.2	0.27 - 0.31	2.2 - 3.0	Pour in Place: 1.5 - 2.5 Blown in Place: 3.5 - 5.0 Spray in Place: 11.0 - 18.0	Low Cost, Good R per inch, Availability.	Combustible, High moisture permeability and absorption, may settle 0-20% if installed at too low a density	HH-1-515D C0739-73
Fiber Glass (3)	2.2	0.45	0.6 - 1.0	Blown in Place: 4.0 - 5.5	Low cost, Non-combustible.	Low R per inch, High moisture permeability, may settle.	HH-1-103A C764-73
Rock Wool (3)	2.9	0.34	1.5 - 2.5	Blown in Place: 4.0 - 5.5	Low cost, Non-combustible.	Modest R per inch, High moisture permeability, may settle.	HH-1-1030A C764-73
Perlite (3)	3.7 - 2.5	0.27 - 0.40	2-11	-	Low Cost, Non-combustible, stable.	High moisture permeability.	HH-1-5748 C549-73
Vermiculite (3)	3.0 - 2.4	0.33 - 0.41	4 - 10	-	Low Cost, Non-combustible, stable.	High moisture permeability.	HH-1-585 C516-75
<u>FOAM IN PLACE</u>							
Polyurethane/ polyisocyanurate (3)	6.2 - 5.8	0.16 - 0.17	2.0	-	High R per inch, may provide infiltration seal, low moisture absorption.	Moderate cost, combustible (polyisocyanurate is less so than polyurethane). May experience some shrinkage.	
Urea-based mixtures (3)	4.2	0.23	0.6 - 0.9	4.5 - 5.5	High R per inch, may provide infiltration seal.	Moderate cost, combustible, improperly installed foam may shrink significantly and/or cause lingering formaldehyde vapors.	
<u>REFLECTIVE INSULATION</u> (4)							
2 Layer 3 Layer	R-5 R-7.5	-	-	1.0 - 3.0	Low cost, Non-combustible, can provide infiltration seal, low thermal mass.	Poor performance where con- duction or convection dominate, dust on reflective surfaces may reduce per- formance.	HH-1-1252B C-236

- Sources: 1. Pittsburgh Corning Literature
2. ASHRAE, Handbook of Fundamentals (1977)
3. R. P. Tye, E. Ashare, E. C. Guyer, A. C. Sharon, "An Assessment of Insulation Materials and Systems for Building Applications (1978).
4. Personal Communication with Follipat, Inc.
* Material Cost only.
† Personal communications with New England installers.

3.3 Major Applications for Generic Building Insulation Materials

Most forms of insulation are only suitable for use in specific applications. The constraints that govern which applications are suitable for a certain insulation include the available financial resources, health hazard restrictions, allowable thicknesses and ease of installation.

Table 3.3 illustrates which insulations are typically selected for specific types of construction. The information contained in this table is based on several assumptions. The wall cavity insulation for retrofit applications were selected assuming that the cavity has been previously enclosed. Also, the flooring applications are for basement floors as opposed to between story flooring. The engineer should compare his particular constraints with those used in typical building construction before using this table.

Table 3.3

MAJOR APPLICATIONS FOR GENERIC INSULATION MATERIALS

INSULATION MAJOR APPLICATIONS	LOOSE FILL INSULATION					RIGID INSULATING BOARDS				
	CELLULOSE	FIBER GLASS	MINERAL FIBER	PERLITE	VERMICULITE	MINERAL/FIBERGLASS	CELLULAR GLASS	CELLULAR PLASTICS	WOOD FIBER	COMPOSITE FOAM/MINERAL
<u>INDUSTRIAL</u>										
<u>Roof/Ceiling</u>										
Above Roof Deck	---	---	---	---	---	N-R	N-R	N-R	N-R	N-R
Below Roof Deck	---	---	---	---	---	---	---	---	---	---
<u>Walls</u>										
In Cavities	---	---	---	N	N	---	N	N	---	---
Sheathing or Siding	---	---	---	---	---	N-R	N-R	N-R	N-R	---
<u>Floors</u>										
Concrete Slab	---	---	---	---	---	---	N-R	N	---	---
Wood or Steel Joists	---	---	---	---	---	---	---	N-R	---	---
<u>COMMERCIAL</u>										
<u>Roof/Ceiling</u>										
Above Roof Deck	---	---	---	---	---	N-R	N-R	N-R	N-R	N
Below Roof Deck	N-R	---	---	---	---	---	---	---	---	---
<u>Walls</u>										
In Cavities	R	---	---	N	N	---	N	N	---	---
Sheathing or Siding	---	---	---	---	---	N-R	N-R	N-R	N-R	---
<u>Floors</u>										
Concrete Slab	---	---	---	---	---	N	N-R	N	---	---
Wood or Steel Joists	---	---	---	---	---	---	---	N-R	---	---
<u>RESIDENTIAL</u>										
<u>Roof/Ceiling</u>										
In-Frame Cavities	N-R	N-R	N-R	N-R	N-R	---	---	---	---	---
Above Roof Sheathing	---	---	---	---	---	N	---	N-R	N	N
Cathedral Ceilings	---	---	---	---	---	N-R	---	N-R	N-R	N-R
<u>Walls</u>										
In-Frame Cavities	R	R	R	R	---	---	---	---	---	---
Sheathing or Siding	---	---	---	---	---	N	---	N-R	N	---
<u>Floors</u>										
Wood Joisted	N-R	---	---	---	---	---	---	---	---	---
Concrete Slab	---	---	---	---	---	N	---	N	---	---
<u>Basement Wall</u>										
Exterior	---	---	---	---	---	N	---	N	---	---
Interior	---	---	---	---	---	---	---	N-R	---	---

N - Used in New Construction
R - Used in Retrofitting

Table 3.3 (Concluded)

MAJOR APPLICATIONS FOR GENERIC INSULATION MATERIALS

MAJOR APPLICATIONS	INSULATING BATT OR BLANKETS		FOAMED IN PLACE INSULATION		SPRAYED IN PLACE INSULATION		OTHER	
	FIBER GLASS	MINERAL FIBER	URETHANE FOAM	UREA BASED FOAM	CELLULOSE	MINERAL FIBER	INSULATING CONCRETE	REFLECTIVE INSULATION
INDUSTRIAL								
<u>Roof/Ceiling</u>								
Above Roof Deck	---	---	N-R	---	---	---	N-R	---
Below Roof Deck	N-R	N-R	R	---	N-R	N	---	N-R
<u>Walls</u>								
In Cavities	N-R	N-R	N-R	---	---	---	---	---
Sheathing or Siding	---	---	---	---	---	---	---	---
<u>Floors</u>								
Concrete Slab	---	---	---	---	---	---	N-R	---
Wood or Steel Joists	N-R	N-R	N-R	---	N	---	N-R	---
COMMERCIAL								
<u>Roof/Ceiling</u>								
Above Roof Deck	---	---	N-R	---	---	---	N-R	---
Below Roof Deck	N-R	N-R	R	---	N-R	N	---	---
<u>Walls</u>								
In Cavities	N-R	N-R	N-R	---	N	---	---	---
Sheathing or Siding	---	---	---	---	---	---	---	---
<u>Floors</u>								
Concrete Slab	---	---	---	---	---	---	N-R	---
Wood or Steel Joists	N-R	N-R	N-R	---	N	---	N-R	---
RESIDENTIAL								
<u>Roof/Ceiling</u>								
In-Frame Cavities	N-R	N-R	---	---	N	---	---	---
Above Roof Sheathing	---	---	N-R	---	---	---	---	N
Cathedral Ceilings	N-R	N-R	---	---	N-R	---	---	---
<u>Walls</u>								
In-Frame Cavities	N	N	N-R	N-R	---	---	---	N
Sheathing or Siding	---	---	---	---	---	---	---	---
<u>Floors</u>								
Wood Joisted	N-R	N-R	---	---	N	---	---	N-R
Concrete Slab	---	---	---	---	---	---	---	---
<u>Basement Wall</u>								
Exterior	---	---	---	---	---	---	---	---
Interior	N-R	N-R	---	---	---	---	---	N

N - Used in New Construction
R - Used in Retrofitting

Section 4
COMPILATION OF MANUFACTURERS DATA

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4.0 General

This section presents the properties of the building insulation materials produced by each responding manufacturer. Within each insulation category (Rigid Insulating Boards, Foamed in Place, etc.) the products are listed alphabetically by the manufacturer's name.

Only a handful of vendors were able to supply enough information to completely fill in a product data sheet. In some cases the incompleted properties were not applicable to the particular material or the federal or ASTM specifications for the material did not require the property to be measured.

Almost all of the manufacturers supplied the R or k- values and the flame spread, fuel contributed and smoke developed indexes.

DEFINITION OF SYMBOLS

The symbols used in the data tables are defined as follows.

COMPOSITION: The composition and form of the material including factors such as closed cell content, blowing agent, fiber size, shot content, flame retardant, etc.

INSULATION PROPERTIES TABLE: This table lists the thermal properties of the material at the given conditions of thickness, temperature, and density at which it has been tested. R is listed as the main property of interest, while k and C are given as back-up numbers.

R: the thermal resistance of the material (hrft²F/BTU)

t: the thickness of the material (inches)

T: the mean temperature of the material during the test (°F)

ρ: the density of the material (lb/ft³)

k: the apparent thermal conductivity of the material, per inch of thickness (BTU-in/hrft²F)

C: the thermal conductance of the material, at the thickness specified (BTU/hrft²F)

TEST: the testing procedure used to determine the listed values

EFFECTS OF SPECIFIED CONDITIONS: This section gives the effects of each of the listed environmental or temporal conditions on the properties of the material, such as dimensional stability, thermal performance, and fire resistance.

AGE: the effects of time

TEMP: the effects of temperature changes, within the safe limits of use

MOISTURE: the effects of humidity or liquid water

WEATHER: the effects of sunlight, freeze-thaw cycling or other climatic conditions

FUNGUS: the tendency of the material to support the growth of fungus or bacteria

FIRE RESISTANCE: In this section, each of the listed combustion parameters is given.

FS, FC, SD: Numerical ratings of the degree of flame spread, fuel contributed and smoke developed by the material in a standard Steiner Tunnel Test (ASTM E-84), as compared to 0 for asbestos-cement board and 100 for untreated red oak. Not intended to reflect actual fire hazard conditions.

IGN TEMP: the ignition temperature of the material (°F)

TOX: the toxicity of the combustion products of the material

TEMP RANGE: The minimum and maximum temperature for which the material may be safely used without breakdown of its properties (°F).

PERM: The permeability of the material to water vapor (perm-in = grains inch/hrft²inch of Hg).

ABS: The ability of the material to absorb moisture (weight percent unless otherwise noted).

C_p: The specific heat at constant pressure of the material (BTU/lbm°F).

CORR (corrosiveness): The tendency of the material to accelerate the corrosion of metallic substances.

CAPIL (capillarity): The ability of the material to draw liquids up into or through itself (high, medium, low, or none).

Section 4.1

LOOSE FILL INSULATIONS

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Table 4.1.1 Loose Fill - Cellulose

COMPANY: AMERICAN HERMCELL				TRADE NAME: American Thermcell			
PROD. TYPE: Cellulose - Blown				COMPOSITION: Borax and boric acid 22%			
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
3.82	.97	75	2.2	.26			AGE: none TEMP: none MOISTURE: k, density increases WEATHER: none FUNGUS: none
							FS: 15 FC: 0 SD: 20 IGN. TMP: none TOX: high
COMMENTS:							
COMMENTS:				COMMENTS:			
COMPANY: APPROVED INSULATION				TRADE NAME: Approved Insulation			
PROD. TYPE: Cellulose - Blown or Poured				COMPOSITION:			
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
							AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none
							FS: none FC: none SD: none IGN. TMP: none TOX: none
COMMENTS: Complies with ASTM C-739-77e.							
COMMENTS:				COMMENTS:			
COMPANY: ARMM INDUSTRIES				TRADE NAME: Weathercheck			
PROD. TYPE: Cellulose - Blown				COMPOSITION: Borax and boric acid 23%			
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
3.83	1	80	2.9	.26	.26		AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none
							FS: 20 FC: 0 SD: 35 IGN. TMP: none TOX: none
							PERM: none ABS: 3.15 Cp: none CORR: none CAPIL: none
COMMENTS:							
COMMENTS:				COMMENTS:			
COMPANY: BONDED INSULATION				TRADE NAME: Bonded Cellulose Insulation			
PROD. TYPE: Cellulose - Blown				COMPOSITION:			
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
4.4	4	75	3.2	.28	.28		AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none
							FS: 25 FC: 5 SD: 15 IGN. TMP: none TOX: none
							PERM: none ABS: 9.5 Cp: none CORR: none CAPIL: none
COMMENTS:							

NOTES:

Table 4.1.1 Loose Fill - Cellulose (Continued)

COMPANY: CELLIN MANUFACTURING										TRADE NAME: Cellin Pac									
PROD. TYPE: Cellulose - Poured										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
2.7						.27	AGE:			FS:	25		PERM:						
							TEMP:			FC:	0		ABS:		10.5				
							MOISTURE:			SD:	10		Cp:						
							WEATHER:			IGN. TMP:			CORR:		none				
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY: CELLIN MANUFACTURING										TRADE NAME: Cellin Craft									
PROD. TYPE: Cellulose - Blown										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
3.8						.26 .26	AGE:			FS:	25		PERM:						
							TEMP:			FC:	0		ABS:		8				
							MOISTURE:			SD:	10		Cp:						
							WEATHER:			IGN. TMP:			CORR:		none				
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY: DIVERSIFIED INSULATION										TRADE NAME: Shelter Shield SS-25									
PROD. TYPE: Cellulose - Loose										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
	100	2.7				.28	AGE:		none	FS:	25		PERM:						
	75	2.7				.27	TEMP:		none	FC:	35		ABS:		5 - 6				
	47	2.7				.25	MOISTURE:		k increases	SD:	0		Cp:						
	75	3.5				.28	WEATHER:		none	IGN. TMP:			CORR:		none				
							FUNGUS:		none	TOX:			CAPIL:		high				
COMMENTS:																			
COMPANY: HAMILTON MANUFACTURING										TRADE NAME: Thermlok									
PROD. TYPE: Cellulose - Blown										COMPOSITION: Borax and boric acid									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
3.4			1.8			.29	AGE:			FS:	20		PERM:						
							TEMP:			FC:	20		ABS:		9.6				
							MOISTURE:			SD:	15		Cp:						
							WEATHER:			IGN. TMP:			CORR:		none				
							FUNGUS:			TOX:			CAPIL:		high				
COMMENTS:																			

NOTES:

Table 4.1.1 Loose Fill - Cellulose (Continued)

COMPANY: IN-SOL INC.										TRADE NAME: In-Sol Shield									
PROD. TYPE: Cellulose - Loose Fill										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNC:				
26	6.8				.26	.038	AGE:					FS:				PERM:			
							TEMP:					FC:				ABS:			
							MOISTURE:					SD:				Cp:			
							WEATHER:					IGN. TMP:				CORR:			
							FUNGUS:					TOX:				CAPIL:			
COMMENTS:																			
COMPANY: INTERNATIONAL UNITED CHEMICAL										TRADE NAME: Fiber-Therm									
PROD. TYPE: Cellulose - Loose										COMPOSITION: Borax and borate									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNC:				
3.73	1	75	2.1	.27	.27	C-177	AGE:	none				FS:				PERM:			-50: 185
							TEMP:	none				FC:				ABS:			< 9
							MOISTURE:	k in bases				SD:				Cp:			
							WEATHER:	not tested				IGN. TMP:				CORR:			none
							FUNGUS:	none				TOX:				CAPIL:			medium
COMMENTS: Also for spray on. See address list for manufacturing plants, including Western weathercheck.																			
COMPANY: IOWA EXCEL										TRADE NAME: XL WOOL									
PROD. TYPE: Cellulose - Blown and Poured										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNC:				
							AGE:					FS:	20			PERM:			-100: 200
							TEMP:					FC:	0			ABS:			
							MOISTURE:					SD:	30			Cp:			
							WEATHER:					IGN. TMP:				CORR:			
							FUNGUS:					TOX:				CAPIL:			
COMMENTS:																			
COMPANY: NATIONAL INSULATION INC.										TRADE NAME: Energy Saver									
PROD. TYPE: Cellulose - Blown and Poured										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNC:				
3.7	1		2.1	.27	.27	C-739	AGE:	may settle				FS:	25 (1)			PERM:			-28: 150
							TEMP:					FC:	0 (1)			ABS:			11.7
							MOISTURE:					SD:	20 (1)			Cp:			
							WEATHER:					IGN. TMP:	1700 (1)			CORR:			none
							FUNGUS:					TOX:				CAPIL:			low
COMMENTS:																			

NOTES: (1) 25 foot tunnel test.

Table 4.1.1 Loose Fill - Cellulose (Continued)

COMPANY: OREN CORPORATION										TRADE NAME: Oren or Overall									
PROD. TYPE: Cellulose - Blown										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
3.7	1	75	2.7	.27	.27	C-518-76	AGE:	none		FS:	15		PERM:			-40:	180		
							TEMP:	none		FC:	0		ABS:				3.0		
							MOISTURE:	none unless saturated		SD:	20		Cp:						
							WEATHER:			IGN. TMP:			CORR:				none		
							FUNGUS:	none		TOX:			CAPIL:				high		
COMMENTS:																			
COMPANY: PATTEN BUILDING SUPPLY										TRADE NAME: Weatherguard									
PROD. TYPE: Cellulose - Blown										COMPOSITION: borax and boric acid 23.6%									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
3.95	1	75	2.7	.25	.25	C-518	AGE:	none		FS:	20		PERM:						
							TEMP:	none		FC:	0		ABS:				3.6		
							MOISTURE:			SD:	20		Cp:						
							WEATHER:	not exposed		IGN. TMP:			CORR:				none		
							FUNGUS:	none		TOX:			CAPIL:				medium		
COMMENTS:																			
COMPANY: RHODE ISLAND ENERGY CORP.										TRADE NAME: Thermo-pal, Thermo-pour									
PROD. TYPE: Cellulose - Blown and Poured										COMPOSITION: Borax and boric acid									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
3.7	1	75	2.5	.27	.27	C-518-76	AGE:	none		FS:	20		PERM:						
							TEMP:	none		FC:	0		ABS:				9.5		
							MOISTURE:	dissipates		SD:	40		Cp:						
							WEATHER:	none		IGN. TMP:			CORR:				none		
							FUNGUS:	none		TOX:			CAPIL:				high		
COMMENTS:																			
COMPANY: THERMOGUARD INSULATION CO.										TRADE NAME: Thermo-guard Blowing Wool, Thermolite									
PROD. TYPE: Cellulose - Blown and Poured										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
3.7			2.5	.27	.27	C-518-70	AGE:	none		FS:	25		PERM:						
							TEMP:	none		FC:	0		ABS:				4		
							MOISTURE:	liquid damages		SD:	25		Cp:						
							WEATHER:	discolors		IGN. TMP:			CORR:				none		
							FUNGUS:	breakdown over long time		TOX:			CAPIL:				high		
COMMENTS:																			
NOTES:																			

Table 4.1.1 Loose Fill - Cellulose (Continued)

COMPANY: THERMAL PRODUCTS COMPANY					TRADE NAME: ThermoCon				
PROD. TYPE: Cellulose-Loose Fill					COMPOSITION:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP. RNG:
3.89	1		2.6			C-418	AGE: Meets ASTM-1499	FS:	PERM:
						C-177	TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: Meets federal specifications HHI-515C,D									
COMPANY: UNITED FIBER CORP.					TRADE NAME: Thermo-O-Sea				
PROD. TYPE: Cellulose - Blown					COMPOSITION:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP. RNG:
3.7			2.3	.27		C-739	AGE:	FS: 15	PERM:
							TEMP:	FC: 0	ABS: <10
							MOISTURE:	SD: 5 - 6	Cp:
							WEATHER:	IGN. TMP:	CORR: None
							FUNGUS: resistant	TOX:	CAPIL: High-Med.
COMMENTS:									
COMPANY: WEATHERGUARD					TRADE NAME:				
PROD. TYPE: Cellulose - loose					COMPOSITION:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP. RNG: < 180
14.6	4		2.1	.28	.068	C-177	AGE: None	FS: 23	PERM:
							TEMP: None	FC: 0	ABS: 10
							MOISTURE: None unless saturated	SD: 35	Cp:
							WEATHER:	IGN. TMP:	CORR: None
							FUNGUS:	TOX:	CAPIL: High-Med.
COMMENTS:									
COMPANY: WESTERN WEATHERCHECK					TRADE NAME: Weathercheck				
PROD. TYPE: Cellulose - Loose					COMPOSITION: Borax and boric acid 21%				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP. RNG: -50 : 200
3.55	1			.28	.28		AGE:	FS: 25	PERM:
							TEMP:	FC: 30	ABS: 9.1
							MOISTURE:	SD: 0	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL: Low
COMMENTS: A subsidiary of International United Chemical Company									

NOTES:

Table 4.1.1 Loose Fil. Cellulose (Concluded)

COMPANY: WEYERHAEUSER		TRADE NAME: Silva Wool	
PROD. TYPE: Cellulose - 1		COMPOSITION: Borax and boric acid	
R	t	ρ	k
6.85	2.0	36	1.5
EFFECTS OF SPECIFIED CONDITION		FIRE RESISTANCE	
AGE: Settles		FS: 20	
TEMP:		FC: 0	
MOISTURE: Cycles cause settling		SD: 20	
WEATHER: Not exposed		IGN. TMP:	
FUNGUS: None		TOX:	
COMMENTS: Made from virgin			

COMPANY:		TRADE NAME:	
PROD. TYPE:		COMPOSITION:	
R	t	ρ	k
EFFECTS OF SPECIFIED CONDITION		FIRE RESISTANCE	
AGE:		FS:	
TEMP:		FC:	
MOISTURE:		SD:	
WEATHER:		IGN. TMP:	
FUNGUS:		TOX:	
COMMENTS:			

COMPANY:		TRADE NAME:	
PROD. TYPE:		COMPOSITION:	
R	t	ρ	k
EFFECTS OF SPECIFIED CONDITION		FIRE RESISTANCE	
AGE:		FS:	
TEMP:		FC:	
MOISTURE:		SD:	
WEATHER:		IGN. TMP:	
FUNGUS:		TOX:	
COMMENTS:			

COMPANY:		TRADE NAME:	
PROD. TYPE:		COMPOSITION:	
R	t	ρ	k
EFFECTS OF SPECIFIED CONDITION		FIRE RESISTANCE	
AGE:		FS:	
TEMP:		FC:	
MOISTURE:		SD:	
WEATHER:		IGN. TMP:	
FUNGUS:		TOX:	
COMMENTS:			

NOTES:

able 4.1.1.2 Loose Fill - Fiberglass

COMPANY: CERTAIN-TEED										TRADE NAME: Insul-Safe									
PROD. TYPE: Fiberglass - blown										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
16.1	5.5	75	.92	.34	.062	C-236	AGE: none				FS: < 25				PERM: .08				
							TEMP: none				FC: < 50				ABS: < 2 (vol)				
							MOISTURE: none				SD: < 50				Cp: .2				
							WEATHER: none				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX:				CAPIL: low				
COMMENTS: Meets Federal Specification HH-1-1030A, Type I, Class A.																			
COMPANY: CERTAIN-TEED										TRADE NAME: Certaineed Standard Blowing Wool									
PROD. TYPE: Fiberglass - blown										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
12.2	5.5	75	.72	.45	.082	C-236	AGE: none				FS: < 25				PERM: .08				
							TEMP: none				FC: < 50				ABS: < 2 (vol)				
							MOISTURE: none				SD: < 50				Cp: .2				
							WEATHER: none				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX:				CAPIL: low				
COMMENTS: Meets Federal Specification HH-1-1030A, Type I, Class B.																			
COMPANY: OWENS CORNING FIBERGLAS										TRADE NAME: Fiberglass Blowing Wool									
PROD. TYPE: Fiberglass - blown										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
11	5	75	.1	.45	.09		AGE: none				FS: 20				PERM: 116				
							TEMP: none				FC: 15				ABS: < 1				
							MOISTURE: none				SD: 20				Cp:				
							WEATHER: none				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX: from binder				CAPIL: none				
COMMENTS: For ceilings and wall cavities.																			
COMPANY: JOHNS-MANVILLE										TRADE NAME:									
PROD. TYPE: Fiberglass - blown										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
				.43			AGE:				FS: < 25				PERM:				
							TEMP:				FC:				ABS: < 2.				
							MOISTURE:				SD: < 50				Cp:				
							WEATHER:				IGN. TMP:				CORR: none				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS: Meets Federal Spec. HH-1-1030A.																			

NOTES:

Table 4.1.3 Loose - Mineral Fiber

COMPANY: CARNEY INSULATION				TRADE NAME: Carney Attic Insulation			
PROD. TYPE: Mineral Fiber - Poured and Blown				COMPOSITION: Shot content: 20%			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
3.0	1	75	2.1	.33	.33	C-177	AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none
							FS: 0 FC: 0 SD: 10 IGN. TMP: none TOX: none
							PERM: > 116 ABS: negligible Cp: .16 CORR: none CAPIL: none
COMMENTS:							
COMPANY: CASCO MINERAL WOOL				TRADE NAME: Casco Blowing Wool			
PROD. TYPE: Mineral Fiber - Blown				COMPOSITION:			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
11.4	4.0	75	1.2	.35	.088	C-518	AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none
							FS: 5 FC: 0 SD: 0 IGN. TMP: none TOX: none
							PERM: < 1600 ABS: .7 Cp: none CORR: none CAPIL: none
COMMENTS:							
COMPANY: ROCKWOOL INDUSTRIES				TRADE NAME: Premium Brand Blowing Wool			
PROD. TYPE: Mineral Wool - Blown				COMPOSITION: Shot content: < 20%			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
2.94	1	75	1.9	.34	.34		AGE: none TEMP: none MOISTURE: transient WEATHER: none FUNGUS: none
							FS: 10 FC: none SD: none IGN. TMP: none TOX: none
							PERM: 116 ABS: 2 Cp: .18 @ 75° CORR: none CAPIL: none
COMMENTS: For attics, sidewalls, retrofit							
COMPANY: ROCKWOOL INDUSTRIES				TRADE NAME: Premium Brand Pouring Wool			
PROD. TYPE: Mineral Fiber - Poured				COMPOSITION: Shot content: < 20%			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION
3.17	1	75	2.5	.32	.32		AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none
							FS: 25 FC: none SD: none IGN. TMP: none TOX: none
							PERM: none ABS: .18 @ 75° Cp: none CORR: none CAPIL: none
COMMENTS:							

NOTES:

Table 4.1.3 Loose Fill - Mineral Fiber (included)

COMPANY: U.S. GYPSUM COMPANY									
TRADE NAME: Ceramafiber Handy Fill									
COMPOSITION: not content: < 15%									
PROD. TYPE: Mineral Fiber - Poured	FIRE RESISTANCE								
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION		
11	3.25	75	3.3	.29	.09	C-518	AGE:	none	PERM:
							TEMP:	none	ABS:
							MOISTURE:	transient	Cp:
							WEATHER:	none	CORR:
							FUNGUS:	none	CAPIL:
COMMENTS: For attics									
TRADE NAME: Ceramafiber Blowing Wool									
COMPOSITION: not content: < 15%									
PROD. TYPE: Mineral Fiber - Blown	FIRE RESISTANCE								
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION		
11	3.75	75	2.0	.34	.09	C-518	AGE:	none	PERM:
							TEMP:	none	ABS:
							MOISTURE:	transient	Cp:
							WEATHER:	none	CORR:
							FUNGUS:	none	CAPIL:
COMMENTS:									
TRADE NAME: Ceramafiber Pouring Insulation									
COMPOSITION:									
PROD. TYPE: Mineral Fiber - Poured	FIRE RESISTANCE								
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION		
6.12	75	3.0	.33	.16		C-518	AGE:	none	PERM:
							TEMP:	none	ABS:
							MOISTURE:	k increases	Cp:
							WEATHER:	none	CORR:
							FUNGUS:	none	CAPIL:
COMMENTS:									
TRADE NAME: Ceramafiber Blowing Wool									
COMPOSITION:									
PROD. TYPE: Mineral Fiber - Blown	FIRE RESISTANCE								
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION		
6.72	75	2.6	.30	.15		C-518	AGE:	none	PERM:
							TEMP:	none	ABS:
							MOISTURE:	k increases	Cp:
							WEATHER:	none	CORR:
							FUNGUS:	none	CAPIL:
COMMENTS:									
NOTES:									

Table 4.1.4 Loose Fill - Perlite

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION: Silicone Treated									
FIRE RESISTANCE:									
TMP RNG: -458 : 1400									
PERM: N/A									
ABS:									
Cp: .22									
CORR: none									
CAPIL: medium									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE: none	FS: 0
-	1	75	2.0	.27		C177-C518	TEMP: none	FC: 0	
-	1	75	5.0	.31		C177-C518	MOISTURE: transient	SD: 0	
-	1	75	8.0	.36		C177-C518	WEATHER: none	IGN. TMP: 2300	
-	1	75	11.0	.40		C177-C518	FUNGUS: none	TOX: none	
COMMENTS: Complete information from The Perlite Institute will be incorporated into the final report. See address list for members									
TRADE NAME:									
COMPOSITION: Silicone treated									
FIRE RESISTANCE:									
TMP RNG: -458 : 1400									
PERM:									
ABS:									
Cp: .22									
CORR: none									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION: Duct Suppressants									
FIRE RESISTANCE:									
TMP RNG: N/A									
PERM: N/A									
ABS:									
Cp: .22									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE: none	FS: 20
							TEMP: none	FC: 15	
							MOISTURE: transient	SD: 25	
							WEATHER: none	IGN. TMP: N/A	
							FUNGUS: none	TOX: N/A	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
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Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									

THE PERLITE INSTITUTE									
PERLITE Loose Fill									
TRADE NAME:									
COMPOSITION:									
FIRE RESISTANCE:									
TMP RNG:									
PERM:									
ABS:									
Cp:									
CORR:									
CAPIL:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	AGE:	FS:
							TEMP:	FC:	
							MOISTURE:	SD:	
							WEATHER:	IGN. TMP:	
							FUNGUS:	TOX:	
COMMENTS:									
TRADE NAME:									

Table 4.1.5 Loose Fill - Urea-Based Foam

COMPANY: AEROLITE SPE Corporation										TRADE NAME: Aerolite									
PROD. TYPE: Urea-formaldehyde-blown										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
4.40	1	30	.45	.23	.23	C-177	AGE: none				FS: 20				PERM:				
4.01	1	72	.46	.25	.25	C-177	TEMP: none				FC: 0				ABS: 2.				
							MOISTURE: none - normal attic				SD: 35				Cp: none				
							WEATHER: none				IGN. TMP: 1235				CORR: none				
							FUNGUS: none				TOX: < wood				CAPIL: none				
COMMENTS: For attic insulation																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			

NOTES:

Table 4.1.6 Loose Fill - Vermiculite

COMPANY: BROUK										TRADE NAME: Micafil									
PROD. TYPE: Vermiculite - Loose Fill										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: -300: 2090				
15	5		3	.33	.066	C-177	AGE: none				FS: 0				PERM:				
							TEMP: none				FC: 0				ABS:				
							MOISTURE: k increases				SD: 0				Cp: .2				
							WEATHER: none				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: low				
COMMENTS: For attics and sidewalls.																			
COMPANY: SCHUNDLER COMPANY										TRADE NAME: Schundler Vermiculite Masonry Fill									
PROD. TYPE: Vermiculite - Loose Fill										COMPOSITION: Silicone treated									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: -45: 760				
				.41			AGE: none				FS: 0				PERM:				
				.42			TEMP: none				FC: < 25				ABS:				
							MOISTURE: repels				SD: < 25				Cp:				
							WEATHER: none				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: low - none				
COMMENTS:																			
COMPANY: SCHUNDLER COMPANY										TRADE NAME: Schundler Attic Insulation									
PROD. TYPE: Vermiculite - Loose Fill										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: -45: 760				
				.41			AGE: none				FS: 0				PERM:				
				.42			TEMP: none				FC: < 25				ABS:				
							MOISTURE: transient				SD: < 25				Cp:				
							WEATHER: none				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: medium				
COMMENTS:																			
COMPANY: VERMICULITE ASSOCIATION										TRADE NAME: Micafil									
PROD. TYPE: Vermiculite - Loose Fill										COMPOSITION: Silicone treated									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 1300				
2.9			4-5	.42		C-177	AGE: none				FS: 0				PERM: nil				
							TEMP: none				FC: 0				ABS: nil				
							MOISTURE: none				SD: 0				Cp: .43				
							WEATHER: none				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: 0				CAPIL: none				
COMMENTS: For cavity fill. The Vermiculite Association represents producers of African Vermiculite. See address list for member manufacturers.																			
COMMENTS:																			

Table 4.1.6 Loose Fill - Vermiculite (Concluded)

VERMICULITE ASSOCIATION										TRADE NAME: Mica Pellets	
PROD. TYPE: Vermiculite - Loose Fill										COMPOSITION: Untreated	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: < 1300
			3	.36		C-177	AGE:	none		FS: 0	PERM: high
							TEMP:	none		FC: 0	ABS: 240
							MOISTURE:	none		SD: 0	Cp: .43
							WEATHER:	none		IGN. TMP: none	CORR: none
							FUNGUS:	none		TOX: 0	CAPIL: high
COMMENTS: For attics.											
See address list for member manufacturers.											
W.R. GRACE										TRADE NAME: Zonolite Concrete Aggregate	
PROD. TYPE: Vermiculite - Loose Concrete Aggregate										COMPOSITION:	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
1.49	1		25	.67	.67	6:1 ratio	AGE:			FS:	PERM:
1.15	1			.87	.87	4:1 ratio	TEMP:			FC:	ABS:
						Aggregate-	MOISTURE:			SD:	Cp:
						concrete	WEATHER:			IGN. TMP:	CORR:
							FUNGUS:			TOX:	CAPIL:
COMMENTS: For use with Portland Cement to form Zonolite Insulating Concrete, to be used in roof decks.											
W.R. GRACE										TRADE NAME: Zonolite Masonry Insulation	
PROD. TYPE: Vermiculite - Loose Fill										COMPOSITION:	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: 0° Abs to 1000°
2.4	1	75	4.6	.41	.41	C518-76	AGE:	Done		FS: 0	PERM:
9.6	4.2	75	5.0	.43	.10		TEMP:	None below 1000°F		FC: 0	ABS:
9.6	4.2	75	7.0	.44	.10		MOISTURE:	None		SD: 0	Cp:
							WEATHER:	None		IGN. TMP:	CORR:
							FUNGUS:	Does not sustain growth		TOX: None	CAPIL:
COMMENTS: Meets Federal Spec. HH-J-585C											
W.R. GRACE										TRADE NAME:	
PROD. TYPE:										COMPOSITION:	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
							AGE:			FS:	PERM:
							TEMP:			FC:	ABS:
							MOISTURE:			SD:	Cp:
							WEATHER:			IGN. TMP:	CORR:
							FUNGUS:			TOX:	CAPIL:
COMMENTS:											

NOTES:

Section 4.2

INSULATING BATTS OR BLANKETS

4.2.1	Fiberglass	58
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Table 4.2.1 Insulating Batts or Blankets - Fiberglass

COMPANY: CERTAIN-TEED										TRADE NAME:	
PROD. TYPE: Fiberglass - Batts and Blankets										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
2.9	7.5	75		.26	.345	C-518	AGE:	none		FS:	< 25
6.0	1.75	75		.29	.167	"	TEMP:	none		FC:	< 50
11.0	8.5	75		.32	.091	" *	MOISTURE:	none		SD:	< 50
19.0	6.0	75		.32	.053	" *	WEATHER:	none		IGN. TMP:	none
30.0	10.0	75		.33	.033	"	FUNGUS:	none		TOX:	low
COMMENTS: Unfaced. Meets Federal Specification HH-I-521E Type 1.											
COMPANY: CERTAIN-TEED										TRADE NAME:	
PROD. TYPE: Fiberglass - Batts and Blankets										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
11.0	8.5	75		.32	.091	C-518 *	AGE:	none		FS:	< 25 (unfaced)
13.0	8.5	75		.27	.077	"	TEMP:	none		FC:	< 50
19.0	6.0	75		.32	.053	" *	MOISTURE:	none		SD:	< 50
22.0	8.5	75		.30	.045	" *	WEATHER:	none		IGN. TMP:	none
30.0	10.0	75		.33	.033	" **	FUNGUS:	none		TOX:	low
COMMENTS: Kraft/Asphalt faced. Meets Federal Specification HH-I-521E Type III. Vapor barrier is flammable.											
COMPANY: CERTAIN-TEED										TRADE NAME:	
PROD. TYPE: Fiberglass - Batts and Blankets										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
11.0	3.5	75		.32	.091	C-518 *	AGE:	none		FS:	< 25 (unfaced)
19.0	6.0	75		.32	.053	C-518 *	TEMP:	none		FC:	< 50
							MOISTURE:	none		SD:	< 50
							WEATHER:	none		IGN. TMP:	none
							FUNGUS:	none		TOX:	low
COMMENTS: Foil faced. Meets Federal Specification HH-I-521E Type III. Vapor barrier is flammable.											
COMPANY: CERTAIN-TEED										TRADE NAME:	
PROD. TYPE: Fiberglass - Batts										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
11.0	3.5	75		.32	.091	C-518 *	AGE:	none		FS:	< 25 (faced)
19.0	6.0	75		.32	.053	C-518 *	TEMP:	none		FC:	0
							MOISTURE:	none		SD:	< 5
							WEATHER:	none		IGN. TMP:	none
							FUNGUS:	none		TOX:	low
COMMENTS: Flame resistant foil faced. Meets Federal Specification HH-I-521E Type III.											

NOTES: * R values verified by NAH3 - Research Foundation's product certification program.

** Extrapolated from above data base.

Table 4.2.1 Insulating Batts or Blankets - Fiberglass (Concluded)

COMPANY: JOHNS-MANVILLE									
PROD. TYPE: Fiberglass - Batts and Blankets									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
		75		.32			AGE:	FS: < 25	PERM:
							TEMP:	FC:	ABS:
							MOISTURE:	SD: < 50	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: Available unfaced, foil faced, and Kraft faced. Meets Federal Spec. HH-I-521E.									
COMPANY: METAL BUILDING INTERIOR PRODUCTS									
PROD. TYPE: Fiberglass - Blanket									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
6	2	75	.75	.33	.17		AGE: none	FS: 25 (faced)	PERM: .2 - 1.0 (faced)
							TEMP: none	FC: 50 "	ABS: none
							MOISTURE: none	SD: 65 "	Cp:
							WEATHER: not exposed	IGN. TMP:	CORR: none
							FUNGUS: none	TOX:	CAPIL: none - low
COMMENTS: Available with vinyl or fabric reinforced vinyl facings.									
COMPANY: OWENS CORNING FIBERGLAS									
PROD. TYPE: Fiberglass - Batts and Rolls									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
		75	< 1	.32			AGE: none	FS: 20	PERM: 116
							TEMP: none	FC: 15	ABS: < 1
							MOISTURE: none	SD: 20	Cp:
							WEATHER: none	IGN. TMP:	CORR: none
							FUNGUS: none	TOX:	CAPIL: none
COMMENTS: Available unfaced, foil faced and Kraft faced. Faced permeability is .5 - 1.0. Kraft faced must not exceed 180°F.									
COMPANY:									
PROD. TYPE:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
							AGE:	FS:	PERM:
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS:									
NOTES:									

Table 4.2.2 Insulating Batts or Blankets - Mineral Fiber

COMPANY: CARNEY INSULATION CORP.									
PROD. TYPE: Mineral Fiber - Batt					TRADE NAME: Carney Golden Fleece				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	COMPOSITION:	Shot content: 20% FIRE RESISTANCE
3.7	1	75	2	.27	.27	C-177	AGE: none TEMP: none MOISTURE: none WEATHER: none FUNGUS: none		TMP RNG: -100: 400 PERM: 116 ABS: negligible Cp: .16 CORR: none CAPIL: none
COMMENTS:									
COMPANY: FORTY-EIGHT INSULATIONS									
PROD. TYPE: Mineral Fiber - Batt and Blanket					TRADE NAME:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	COMPOSITION:	Shot content: 21% FIRE RESISTANCE
3.7	1	75	2.3	.27	.27		AGE: none TEMP: none MOISTURE: affects binder WEATHER: affects binder FUNGUS: none		TMP RNG: 450 PERM: ABS: < 1. Cp: .2 CORR: none CAPIL:
COMMENTS: Available unfaced, foil faced and Kraft faced.									
COMPANY: ROCKWOOL INDUSTRIES									
PROD. TYPE: Mineral Fiber - Batt					TRADE NAME: Premium Brand Batts				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	COMPOSITION:	Shot content: 20% FIRE RESISTANCE
3.14	1	75	1.5	.32	.32		AGE: none TEMP: none MOISTURE: transient WEATHER: none FUNGUS: none		TMP RNG: 116 PERM: 2 ABS: .18 CORR: none CAPIL:
COMMENTS:									
COMPANY: U.S. GYPSUM CO.									
PROD. TYPE: Mineral Fiber - Semi Rigid Felt					TRADE NAME: Thermafiber Curtain Wall				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	COMPOSITION:	Shot content: 15% FIRE RESISTANCE
	75	4	.25			C-518	AGE: none TEMP: none MOISTURE: transient WEATHER: none FUNGUS: none		TMP RNG: ambient PERM: 15 - 20 ABS: 0 - 15 Cp: 0 CORR: none CAPIL: none
	75	6	.24			C-518			
	75	8	.23			C-518			
COMMENTS: For curtain wall spandrel panels. Available unfaced and foil faced.									
NOTES:									

Table 4.2.2 Insulating Batts or Blankets - Mineral Fiber (Concluded)

COMPANY: U.S. GYPSUM										TRADE NAME: Thermafiber Blankets									
PROD. TYPE: Mineral Fiber - Blanket										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: ambient				
11	3	75	2	.27	.09	C-518	AGE: none				FS: 15				PERM: .3 - 1.0 (faced)				
							TEMP: none				FC: 0				ABS: < 1				
							MOISTURE: transient				SD: 0				Cp: none				
							WEATHER: none				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: none				
COMMENTS: Available unfaced, foil faced and asphalt faced. Asphalt is combustible.																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
NOTES:																			

Section 4.3

RIGID INSULATING BOARDS

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COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									

Table 4.3.2 Rigid Insulating Boards - Composite

COMPANY: APACHE FOAM PRODUCTS										TRADE NAME: Apache Millox									
PROD. TYPE: Perlite - Urethane Board										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 250				
		75	2	.13		foam only	AGE:	none			FS:				PERM:				
							TEMP:	none			FC:				ABS:				
							MOISTURE:	k increases			SD:				Cp:				
							WEATHER:	discolors			IGN. TMP:				CORR:				none
							FUNGUS:	none			TOX:				CAPIL:				none
COMMENTS: Asphalt-felt on urethane side. Passes FM Class 1 and U.L. Construction 1 and 2.																			
COMPANY: DRYVIT SYSTEM										TRADE NAME: Dryvit									
PROD. TYPE: See comments										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
4.17	1		1	.24	.24	C-177	AGE:	none			FS:	5			PERM:	18.			
						board only	TEMP:	none			FC:	0			ABS:	2.			
							MOISTURE:				SD:	50			Cp:				
							WEATHER:	none			IGN. TMP:	600			CORR:	none			
							FUNGUS:				TOX:	< wood			CAPIL:	none			
COMMENTS: An external system, consisting of adhesive, expanded polystyrene board, reinforcing cloth and finish.																			
COMPANY: ELWIN & SMITH DIV. OF CYCLOPS										TRADE NAME: Foamwall									
PROD. TYPE: See below.										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 250				
8.3	1		3	.12	.12	not aged	AGE:	none			FS:	20			PERM:				
							TEMP:	none			FC:	0			ABS:				
							MOISTURE:	none			SD:	85 - 145			Cp:				
							WEATHER:	none			IGN. TMP:				CORR:				
							FUNGUS:	none			TOX:				CAPIL:				
COMMENTS: A factory assembled composite wall panel consisting of urethane foam and galvanized steel skins. Available in several patterns and finishes.																			
COMPANY: G.A.F. CORP.										TRADE NAME: Gaftemp									
PROD. TYPE: Urethane + Perlite - Board										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 200				
							AGE:	none			FS:	75 (foam)			PERM:	< 1.			
							TEMP:	none			FC:				ABS:	1.5 (vol)			
							MOISTURE:	degrades perlite			SD:				Cp:				
							WEATHER:	degrades perlite			N. TMP:				CORR:				
							FUNGUS:	degrades perlite			TOX:				CAPIL:	low			
COMMENTS:																			

NOTES:

Table 4.3.2 Rigid Insulating Boards - Composite (Continued)

COMPANY: GREFCO										TRADE NAME: Permalite PK									
PROD. TYPE: Urethane Perlite - Board										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
7.69	1.5	75				(1)	AGE:				FS:				FS:				
10.00	1.8	75				(1)	TEMP: 2% linear expansion @ 158°F				FC:				ABS:				
14.24	2.5	75				(1)	MOISTURE: and 90-100% RH for 24 hrs.				SD:				Cp:				
20.00	3.1	75				(1)	WEATHER: don't expose				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS: Asphalt felt on urethane side.																			
COMPANY: GREFCO										TRADE NAME: Permalite PK Plus									
PROD. TYPE: Perlite Urethane - Board										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
10.00	2.35	75				(1)	AGE:				FS:				PERM:				
12.50	2.70	75				(1)	TEMP: 2% linear expansion @ 158°F				FC:				ABS:				
16.67	3.25	75				(1)	MOISTURE: and 90-100% RH for 24 hrs.				SD:				Cp:				
20.00	3.65	75				(1)	WEATHER: don't expose				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS: Urethane sandwiched between perlite.																			
COMPANY: HOMASOTE CO.										TRADE NAME: Thermasote									
PROD. TYPE: Wood Fiber/Urethane - Board										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: -50: 200				
7	1.2			.17			AGE: none				FS:				PERM:				
							TEMP: none				FC:				ABS:				
							MOISTURE: none				SD:				Cp:				
							WEATHER: none				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX:				CAPIL: low				
COMMENTS:																			
COMPANY: JOHNS-MANVILLE										TRADE NAME: Fesco-Foam									
PROD. TYPE: Perlite/Urethane - Board										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
6.67	1.5			.15			AGE: none				FS:				PERM: 1.				
							TEMP:				FC:				ABS: 1.				
							MOISTURE: degrades				SD:				Cp: .3				
							WEATHER: don't expose				IGN. TMP:				CORR: none				
							FUNGUS:				TOX:				CAPIL: none				
COMMENTS: Asphalt felt on urethane side. Factory Mutual Class 1 and U.L. co nstructions 1, 2, and 27.																			

Table 4.3.2 Rigid Insulating Boards - Composite (Concluded)

COMPANY: JOHNS-MANVILLE										
TRADE NAME: Transifoam										
COMPOSITION:										
PROD. TYPE: Polystyrene - Asbestos Cement - Board										
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:	< 150
1				.34			AGE: none	FS:	PERM:	
1-1/8				.29			TEMP: none	FC:	ABS:	
1-9/16				.20			MOISTURE: none	SD:	Cp:	
2				.15			WEATHER: none	IGN. TMP:	CORR:	none
							FUNGUS: not significant	TOX:	CAPIL:	
COMMENTS: Cement boards sandwich foam.										
COMPANY: PANEL ERA										
TRADE NAME: Insul Wal										
COMPOSITION:										
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:	< 200
	50			.13			AGE: none	FS: 30 - 45	PERM: 2.	
							TEMP: none	FC:	ABS:	negligible
							MOISTURE: softens gypsum	SD: 200	Cp:	
							WEATHER: affects gypsum	IGN. TMP:	CORR:	none
							FUNGUS: gypsum supports	TOX:	CAPIL:	
COMMENTS: A sandwich board of gypsum board, urethane foam and foil-kraft laminate.										
COMPANY: THERMAL SYSTEMS, INC.										
TRADE NAME: TG1000										
COMPOSITION:										
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:	
8.33	1.5						AGE:	FS:	PERM:	
12.44	2.0						TEMP:	FC:	ABS:	
16.66	2.5						MOISTURE:	SD:	Cp:	
20.82	3.0						WEATHER:	IGN. TMP:	CORR:	
							FUNGUS:	TOX:	CAPIL:	
COMMENTS: Class I metal deck insulation. Felt faced urethane bonded to perlite board.										
COMPANY: THERMAL SYSTEMS, INC.										
TRADE NAME: Thermowall										
COMPOSITION:										
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:	
10	1 1/4					(1)	AGE:	FS:	PERM:	
12	1 1/2						TEMP:	FC:	ABS:	
14	1 3/4						MOISTURE:	SD:	Cp:	
16	2						WEATHER:	IGN. TMP:	CORR:	
							FUNGUS:	TOX:	CAPIL:	
COMMENTS: Several wallboard material options are available, foil faced on other side. Special clips are provided for mounting boards to wall.										

NOTES: (1) Based on 3/8" reflective air space on foil side.

Table 4.3.3 Rigid Insulating Boards - Fiberglass

COMPANY: METAL BUILDING INTERIOR PRODUCTS										TRADE NAME:									
PROD. TYPE: Fiberglass - Board										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
4	1			.25	.25		AGE: none				FS: 25 (faced)				PERM: 1 - .2				
							TEMP: none				FC: 50 "				ABS: none				
							MOISTURE: none				SD: 60 "				Cp: none				
							WEATHER: not exposed				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX:				CAPIL: none - low				
COMMENTS: Available with vinyl or fabric reinforced vinyl facing.																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			

NOTES:

Table 4.3.4 Rigid Insulating Boards - Perlite

COMPANY: GREECO										TRADE NAME: Permalite Sealskin									
PROD. TYPE: Perlite - Board										COMPOSITION: Perlite Cellulose Binder									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
2.78	1		11	.36	.36	C-518	AGE:			FS: 25			PERM:						
							TEMP:			FC: 30			ABS: 1.2						
							MOISTURE:			SD: 5			Cp:						
							WEATHER: don't expose			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS: For roofing.																			
TMP RNG: < 250																			
PERM:																			
ABS: 1.2																			
Cp:																			
CORR:																			
CAPIL:																			
COMMENTS:																			
COMPANY: JOHNS-MANVILLE										TRADE NAME: Fesco Board									
PROD. TYPE: Perlite - Board										COMPOSITION: Perlite									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
2.78	1	75	10	.36	.36		AGE: none			FS: < 25			PERM: 25						
							TEMP: none			FC: 25			ABS: 1.5 (vol) 2 hrs						
							MOISTURE: degrades			SD:			Cp: .3 @ 75°F						
							WEATHER: don't expose			IGN. TMP:			CORR:						
							FUNGUS: none			TOX:			CAPIL: none						
COMMENTS: For roofing.																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:																			

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam*

ALL-FOAM DIV. OF DONRAY PRODUCTS										TRADE NAME: All-Foam	
PROD. TYPE: Polystyrene - Board										COMPOSITION: 95% closed cells. Flame retardant.	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: < 167
4.55		0	1.5	.22			AGE:	none		FS:	5
4.17		75	1.5	.24			TEMP:	none		FC:	0
3.70		150	1.5	.27			MOISTURE:			SD:	40 - 350
							WEATHER:	U.V. degrades		IGN. TMP:	none
							FUNGUS:	none		TOX:	none
COMMENTS:											
ARKANSAS PLASTICS										TRADE NAME:	
PROD. TYPE: Polystyrene - Board										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: -40: 170
4.17	1	40	1	.24	.24		AGE:	none		FS:	5
3.85	1	75	1	.26	.26		TEMP:	none		FC:	1.2 - 2.2
							MOISTURE:	small effects		SD:	< 2
							WEATHER:	U.V. discolors		IGN. TMP:	Cp:
							FUNGUS:	none		TOX:	none
COMMENTS: For sheathing.											
BASF Wyandotte										TRADE NAME:	
PROD. TYPE: Polystyrene - Board										COMPOSITION: 100% closed cells.	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: < 167
	75	1	.26			C-177 and	AGE:	none		FS:	5 - 25
	75	1.5	.24			C-518	TEMP:	none		FC:	PERM: 5 - 1.5
	75	2	.23			"	MOISTURE:	k increases		SD:	ABS: 1.8
							WEATHER:	U.V. degrades		IGN. TMP:	Cp: .3
							FUNGUS:	none		TOX:	600
COMMENTS: See BASF on address list for polystyrene board manufacturers using BASF polystyrene beads.											
BENOIT, INC.										TRADE NAME: Benoit Tapered Foam	
PROD. TYPE: Polystyrene - Tapered Block										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: < 150
	40	1	.24			C-177	AGE:	none		FS:	5
	75	1	.26			C-177	TEMP:	none		FC:	PERM: 1.5 - 3
							MOISTURE:	k increases		SD:	ABS: < 2
							WEATHER:	U.V. degrades		IGN. TMP:	Cp: 20 - 130
							FUNGUS:	none		TOX:	none
COMMENTS: Custom fabricated tapered roof system.											

NOTES: * Molded bead board unless designated otherwise.

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Continued)

COMPANY: COASTAL FOAM INC.				TRADE NAME: Coastalite			
PROD. TYPE: Polystyrene - Board				COMPOSITION: Antimony dioxide flame retardant.			
R	t	T	ρ	k	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
4.44	1	40	1	.23	.23	C-236-66	AGE: FS: 1.4
							TEMP: FC: 2. (vol)
							MOISTURE: SD: Cp: none
							WEATHER: IGN. TMP: none
							FUNGUS: TOX: none
COMMENTS:							
COMPANY: DOW CHEMICAL U.S.A.				TRADE NAME: Styrofoam XFS 43001			
PROD. TYPE: Polystyrene - Extruded Board				COMPOSITION: 100% closed cell. Fluorocarbon blown.			
R	t	T	ρ	k	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
6.2	1	0	2.6	.16	.16	aged	AGE: FS: .4
5.0	1	75	2.6	.20	.20		TEMP: FC: .5 (vol)
4.2	1	150	2.6	.24	.24		MOISTURE: SD: Cp: .27 @ 40°F
							WEATHER: IGN. TMP: none
							FUNGUS: TOX: none
COMMENTS: For roofing and plaza applications. Produced with a dense surface skin and channelled edges for drainage.							
COMPANY: DOW CHEMICAL U.S.A.				TRADE NAME: Styrofoam RM			
PROD. TYPE: Polystyrene - Extruded Board				COMPOSITION: 100% closed cell. Fluorocarbon blown.			
R	t	T	ρ	k	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
6.2	1	0	2.3	.16	.16	aged	AGE: FS: .4
5.0	1	75	2.3	.20	.20		TEMP: FC: .55 (vol)
4.2	1	150	2.3	.24	.24		MOISTURE: SD: Cp: .27 @ 40°F
							WEATHER: IGN. TMP: none
							FUNGUS: TOX: none
COMMENTS: For use in IRMA roofing system. Produced with a dense surface skin and channelled edges for drainage.							
COMPANY: DOW CHEMICAL U.S.A.				TRADE NAME: Styrofoam SM and TG.			
PROD. TYPE: Polystyrene - Extruded Board				COMPOSITION: 100% closed cell. Fluorocarbon blown.			
R	t	T	ρ	k	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
6.2	1	0	2.0	.16	.16	aged	AGE: FS: .6
5.0	1	75	2.0	.20	.20		TEMP: FC: .7 (vol)
4.2	1	150	2.0	.24	.24		MOISTURE: SD: Cp: .27 @ 40°F
							WEATHER: IGN. TMP: none
							FUNGUS: TOX: none
COMMENTS: For walls and foundations. Produced with a dense surface skin. TG is tongue and grooved, SM is blunt.							

NOTES:

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Continued)

COMPANY: DOW CHEMICAL U.S.A.										TRADE NAME: Styrofoam HD 1623											
PROD. TYPE: Polystyrene - Extruded Board										COMPOSITION: 100% closed cell. Fluorocarbon blown.											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RING: < 165								
6.2	1	0	3.3	.16	.16		AGE: k increases from .12 init.			FS:			PERM: .6								
5.0	1	75	3.3	.20	.20		TEMP: none			FC:			ABS: .7								
4.2	1	150	3.3	.24	.24		MOISTURE: may increase k			SD:			Cp: .27 @ 40°F								
							WEATHER: U.V. degrades			IGN. TMP:			CORR: none								
							FUNGUS: none			TOX:			CAPIL: none								
COMMENTS: High compressive strength.																					
COMPANY: DOW CHEMICAL U.S.A.										TRADE NAME: Styrofoam 1B											
PROD. TYPE: Polystyrene - Extruded Board										COMPOSITION: 100% closed cell. Fluorocarbon blown.											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RING: < 165								
5.9	1	0	1.8	.21	.21		AGE: k increases from .16 init.			FS:			PERM: .9								
3.8	1	75	1.8	.25	.25		TEMP: none			FC:			ABS: .5 (vol)								
3.3	1	150	1.8	.30	.30		MOISTURE: may increase k			SD:			Cp: .27 @ 40°F								
							WEATHER: U.V. degrades			IGN. TMP:			CORR: none								
							FUNGUS: none			TOX:			CAPIL: none								
COMMENTS: For panel cores.																					
COMPANY: DREW FOAM										TRADE NAME:											
PROD. TYPE: Polystyrene - Board										COMPOSITION: Flame retardant added.											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RING: -300; 167								
4.17	1			.24			AGE: none			FS: 5			PERM: 1.2 - 3.0								
							TEMP: none			FC:			ABS: < 2.5 (vol)								
							MOISTURE: none			SD: 15			Cp:								
							WEATHER: U.V. degrades			IGN. TMP:			CORR: none								
							FUNGUS: none			TOX:			CAPIL: none								
COMMENTS:																					
COMPANY: EFP										TRADE NAME: Enfo											
PROD. TYPE: Polystyrene - Board										COMPOSITION:											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RING: < 200								
4.34	1	40	1.0	.23	.23	C-177	AGE: none			FS: 5			PERM: 2.								
4.02	1	75	1.0	.25	.25	C-177	TEMP: none			FC:			ABS: .8								
4.55	1	40	1.5	.22	.22	C-177	MOISTURE: minimal			SD: 15 - 85			Cp:								
4.35	1	75	1.5	.23	.23	C-177	WEATHER: U.V. degrades			IGN. TMP: 230			CORR: none								
							FUNGUS: none			TOX:			CAPIL: low								
COMMENTS:																					

NOTES:

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Continued)

COMPANY: FAKON MFG. OF MICHIGAN									
TRADE NAME:									
COMPOSITION:									
PROD. TYPE:	Polystyrene - Board			EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE		
R	t	T	ρ	k	C	TEST	AGE:	FS:	TMP RNG:
		0		.20			TEMP:	FC:	PERM:
		75		.24			MOISTURE:	SD:	ABS:
							WEATHER:	IGN. TMP:	Cp:
							FUNGUS:	TOX:	CORR:
									CAPIL:
COMMENTS: Available with flame retardant added.									
COMMENTS:									
COMPANY: FOAM MASTER									
TRADE NAME: Master Board									
COMPOSITION: flame retardant added									
PROD. TYPE:	Polystyrene - Board			EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE		
R	t	T	ρ	k	C	TEST	AGE:	FS:	TMP RNG:
4.3		75	1	.26			TEMP:	FC:	PERM:
							MOISTURE:	SD:	ABS:
							WEATHER:	IGN. TMP:	Cp:
							FUNGUS:	TOX:	CORR:
									CAPIL:
COMMENTS:									
COMPANY: FOAM PLASTICS OF NEW ENGLAND									
TRADE NAME:									
COMPOSITION: 100% closed cell.									
PROD. TYPE:	Polystyrene - Board			EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE		
R	t	T	ρ	k	C	TEST	AGE:	FS:	TMP RNG:
		75	1.0	.26		C-177 and	TEMP:	FC:	PERM:
		75	1.5	.24		C-518	MOISTURE:	SD:	ABS:
		75	2.0	.23			WEATHER:	IGN. TMP:	Cp:
							FUNGUS:	TOX:	CORR:
									CAPIL:
COMMENTS:									
COMPANY: FOAM PRODUCTS									
TRADE NAME: Expanda-Lite									
COMPOSITION: 100% closed cell									
PROD. TYPE:	Polystyrene - Board			EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE		
R	t	T	ρ	k	C	TEST	AGE:	FS:	TMP RNG:
4.16	1	40	1	.24	.24	C-177	TEMP:	FC:	PERM:
4.35	1	40	1.5	.23	.23		MOISTURE:	SD:	ABS:
							WEATHER:	IGN. TMP:	Cp:
							FUNGUS:	TOX:	CORR:
									CAPIL:
COMMENTS:									

NOTES:

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Continued)

THE GILMAN BROTHERS										TRADE NAME: Cellulite	
PROD. TYPE: Polystyrene - Board										COMPOSITION: Closed cell foam blown with pentane	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
4.27	983	40	1.11	.23	.234	C-177	AGE:	none		FS:	5 - 10
3.97	985	75	1.11	.249	.252	C-177	TEMP:	will distort @ > 165°F		FC:	PERM: (1)
4.37	997	40	1.40	.228	.229	C-177	MOISTURE:	none		SD:	ABS: (2)
4.07	998	75	1.40	.246	.246	C-177	WEATHER:	surface discoloration		IGN. TMP:	Cp: .29
							FUNGUS:	none		TOX: CO ₂ fumes	CORR: none
										CAPIL:	none
COMMENTS:											
HURSTLINE SALES										TRADE NAME: R-White	
PROD. TYPE: Polystyrene - Board										COMPOSITION:	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
			1				AGE:			FS:	10
							TEMP:			FC:	PERM: 1.2 - 3.0
							MOISTURE:			SD:	ABS: < 2.
							WEATHER:	resistant		IGN. TMP:	Cp:
							FUNGUS:	none		TOX:	CORR: none
										CAPIL:	none
COMMENTS:											
IOWA MANUFACTURING SPECIALISTS										TRADE NAME: Erono Foam Solar Insulation	
PROD. TYPE: Polystyrene - Board										COMPOSITION:	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
4.3	1	75	1	.23	.23	C-236-66	AGE:			FS:	5
4.7	1	40	1	.21	.21	C-236-66	TEMP:			FC:	PERM: .6 - 1.4
							MOISTURE:	none		SD:	ABS: < 2.
							WEATHER:	U.V. degrades		IGN. TMP:	Cp:
							FUNGUS:			TOX:	CORR: none
										CAPIL:	none
COMMENTS: Available from 1 to 2-1/4 lb/ft ³ density in 1/4 lb/ft ³ increments.											
MID-AMERICAN INDUSTRIES										TRADE NAME: Perma-foam	
PROD. TYPE: Polystyrene - Board										COMPOSITION:	
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	
4.17	1	75	1-2	.26	.26		AGE:	none		FS:	5
							TEMP:	none		FC:	PERM: 1.3
							MOISTURE:	none		SD:	ABS: .7
							WEATHER:	don't expose		IGN. TMP:	Cp: 160
							FUNGUS:	none		TOX:	CORR: none
										CAPIL:	none
COMMENTS:											

NOTES: (1) 1 pcf - 1.2-2.2 perminch, 1.5 pcf - 0.9-1.2 perminch, 2 pcf - 0.6-0.8 perminch.
 (2) 1 pcf - <2.5% Vol, 1.5 pcf - <2.0% Vol, 2 pcf - 2.0% Vol.

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Continued)

COMPANY: PANEL FOAM				TRADE NAME:			
PROD. TYPE: Polystyrene - Board				COMPOSITION: Flame retardant added.			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
4.17	1	40	1.1 .24 .24	C-518	AGE: very low	FS: 10	PERM: 1.2
					TEMP: very low	FC: 5 - 20	ABS: < 2. (vol)
					MOISTURE: very low	SD: 10 - 55	Cp: none
					WEATHER: don't expose to U.V.	IGN. TMP: 600	CORR: none
					FUNGUS: none	TOX: < wood	CAPIL: none
COMMENTS:							
COMPANY: PANEL FOAM				TRADE NAME: Super R Plus			
PROD. TYPE: Polystyrene - Board				COMPOSITION: Flame retardant added.			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
7.1	1		1.1 .14 .14	C-236	AGE: very low	FS: 10	PERM: 1.2
					TEMP: very low	FC: 5 - 20	ABS: < 2. (vol)
					MOISTURE: very low	SD: 10 - 55	Cp: none
					WEATHER: don't expose to U.V.	IGN. TMP: 600	CORR: none
					FUNGUS: none	TOX: < wood	CAPIL: none
COMMENTS: Foil faced. R-value includes reflective airspace. R = 4.17 without the airspace.							
COMPANY: PLASTIFOAM				TRADE NAME: Plastifoam			
PROD. TYPE: Polystyrene - Board				COMPOSITION:			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
4.16	1	40	1 .24 .24	C-197	AGE: none	FS: 10 - 15	PERM: 1.2 - 3.0
					TEMP: none	FC: 5 - 50	ABS: < 2. (vol)
					MOISTURE: k increases	SD: 10 - 100	Cp: none
					WEATHER: U.V. degrades	IGN. TMP: 675	CORR: none
					FUNGUS: none	TOX: toxic	CAPIL: none
COMMENTS: Available with or without flame retardant.							
COMPANY: POLY FOAM				TRADE NAME:			
PROD. TYPE: Polystyrene - Board				COMPOSITION: Flame retardant added			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
		40	1 .24		AGE: none	FS: none	PERM: none
					TEMP: none	FC: none	ABS: none
					MOISTURE: none	SD: none	Cp: none
					WEATHER: none	IGN. TMP: none	CORR: none
					FUNGUS: none	TOX: none	CAPIL: none
COMMENTS:							

NOTE:

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Continued)

COMPANY: W.R. GRACE							TRADE NAME: Insulperm		
PROD. TYPE: Polystyrene - Board							COMPOSITION:		
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
4.0	1			.25	.25		AGE:	FS:	PERM:
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For use with Zonolite Concrete as a roof deck system. Boards are holed and slotted to improve concrete adhesion.									
COMPANY: W.R. GRACE							TRADE NAME: Zonolite Thermo-Stud		
PROD. TYPE: Polystyrene - Board							COMPOSITION:		
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
4.2	1	40	1	.24	.24	C-518	AGE: None	FS: < 25	PERM: < 165
3.9	1	75	1	.26	.26	C-518	TEMP: Decomposes @ approx. 250°F	FC:	PERM: 1.2 - 3.0
							MOISTURE: None	SD: < 450	ABS: < 2.0
							WEATHER: U.V. can yellow surface	IGN. TMP: 600-650°F	Cp:
							FUNGUS: Does not sustain growth	TOX:	CORR: None
COMMENTS: Manufactured with embedded metal furring strip for wall mounting.									
COMPANY: W.R. GRACE							TRADE NAME: Zonolite Styrene Foam		
PROD. TYPE: Polystyrene - Board and Block							COMPOSITION:		
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
4.2	1	40	1	.24	.24	C-518	AGE: None	FS: < 25	PERM: < 165
3.9	1	75	1	.26	.26	C-518	TEMP: Decomposes @ approx. 250°F	FC:	PERM: 1.2 - 3.0
							MOISTURE: None	SD: < 450	ABS: < 2.0
							WEATHER: U.V. can yellow surface	IGN. TMP: 600-650°F	Cp:
							FUNGUS: Does not sustain growth	TOX:	CORR: None
COMMENTS:									
COMPANY: WESTERN INSULFOAM							TRADE NAME: Insulfoam		
PROD. TYPE: Polystyrene - Board							COMPOSITION:		
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
	40			.22		C-177-63	AGE:	FS: 5 - 10	PERM: < 190
	75			.24			TEMP: none	FC: 0 - 50	PERM: 1.2 - 2.0
							MOISTURE:	SD: 10 - 100	ABS: < 2. (vol)
							WEATHER:	IGN. TMP:	Cp:
							FUNGUS: none	TOX: same as wood	CORR:
COMMENTS: Also available as vented roof system - trade name Tuffroof, and as tapered blocks - trade name Insultaper									

NOTES:

Table 4.3.5 Rigid Insulating Boards - Polystyrene Foam (Concluded)

POLYSTYRENE AND CO.										TRADE NAME: Acraspan															
Polystyrene - Board										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 165			
4.17		1		40		1		.24		.24		C-177 or		AGE: None				FS: < 25				PERM: 1.2 - 3.0			
4.85		1		75		1		.26		.26		C-518		TEMP: Not usable > 160°F				FC:				ABS: < 2.5			
4.76		1		40		2		.21		.21				MOISTURE: Small effect				SD: 45 - 125				Cp:			
4.35		1		75		2		.23		.23				WEATHER: U.V. affects surface				IGN. TMP:				CORR: Low			
														FUNGUS: None				TOX:				CAPIL: None			
COMMENTS:																									
COMPANY: SOUTHEASTERN FOAM PRODUCTS, INC.										TRADE NAME: Permaspan															
PROD. TYPE: Polystyrene-Board										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:-50 - 160°F			
4.17		1		40		1		.24		.24		C-177 or		AGE: None				FS: < 25				PERM: 1.2 - 3.0			
4.85		1		75		1		.26		.26		C-518		TEMP: Not usable > 160°F				FC:				ABS: < 2.5			
4.76		1		40		2		.21		.21				MOISTURE: Small effect				SD: 45 - 125				Cp:			
4.35		1		75		2		.23		.23				WEATHER: U.V. affects surface				IGN. TMP:				CORR: Low			
														FUNGUS: None				TOX:				CAPIL: None			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:			
														AGE:				FS:				PERM:			
														TEMP:				FC:				ABS:			
														MOISTURE:				SD:				Cp:			
														WEATHER:				IGN. TMP:				CORR:			
														FUNGUS:				TOX:				CAPIL:			
COMMENTS:																									
COMPANY:										TRADE NAME:															
PROD. TYPE:										COMPOSITION:															
R		t		T		p		k		C		TEST		EFFECTS OF SPECIFIED CONDITION				FIRE							

Table 4.3.6 Rigid Insulating Boards - Polyurethane/Polyisocyanurate Foam

COMPANY: APACHE FOAM PRODUCTS				TRADE NAME: Apache Standard Roofing			
PROD. TYPE: Urethane - Board				COMPOSITION: Fluorocarbon blown			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG: < 250
	75	2	.13	AGE: not aged	FS:	PERM:	< 1
				TEMP: none	FC:	ABS:	
				MOISTURE: k increases	SD:	Cp:	
				WEATHER: discolors	IGN. TMP:	CORR:	none
				FUNGUS: none	TOX:	CAPIL:	none
COMMENTS: Faced with asphalt saturated felt on both sides.							
COMPANY: APACHE FOAM PRODUCTS				TRADE NAME: Apache Plaza Insulation			
PROD. TYPE: Urethane - Board				COMPOSITION:			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG: < 250
	75	3	.13	AGE: not aged	FS:	PERM:	< 1
				TEMP: none	FC:	ABS:	
				MOISTURE: k increases	SD:	Cp:	
				WEATHER: discolors	IGN. TMP:	CORR:	none
				FUNGUS: none	TOX:	CAPIL:	none
COMMENTS: Faced with asphalt saturated felt on both sides.							
COMPANY: B.F. GOODRICH				TRADE NAME: Lexfoam			
PROD. TYPE: Urethane - Board				COMPOSITION: Blown with R-11 and water			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
	75	2.4	.13	AGE: not aged	FS: < 75	PERM:	
				TEMP:	FC:	ABS:	
				MOISTURE:	SD:	Cp:	
				WEATHER:	IGN. TMP:	CORR:	none
				FUNGUS:	TOX:	CAPIL:	
COMMENTS: For flat industrial and commercial roofs.							
COMPANY: CELOTEX				TRADE NAME: Thermax TF 610 and TF 600			
PROD. TYPE: Isocyanurate - Board				COMPOSITION:			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG: -100: 250
7.25	1	75	.14	AGE: R drops from 9 in 1 yr.	FS: 25	PERM:	< .01
8.34	1	40	.12	TEMP: none	FC: 5 - 15	ABS:	< 1 (vol)
				MOISTURE: none	SD: 75 - 200	Cp:	.22
				WEATHER: faced - none	IGN. TMP: 920	CORR:	none
				FUNGUS: none	TOX:	CAPIL:	low
COMMENTS: Glass fiber reinforced and aluminum foil faced on both sides.							

NOTES:

Table 4.3.6 Rigid Insulating Boards - Polyurethane/Polyisocyanurate Foam (Continued)

COMPANY: CPR DIVISION, UPJOHN CO.										TRADE NAME: U-Thane 190, 210 and Tryver 9545											
PROD. TYPE: Isocyanurate - Board										COMPOSITION: 90% closed cells											
EFFECTS OF SPECIFIED CONDITION										FIRE RESISTANCE											
R	t	T	ρ	k	C	TEST	AGE:			FS:			25 - 30			PERM:			2. - 3.		
		75	2	.15			TEMP:			FC:			0 - 25			ABS:			.04 (vol)		
							MOISTURE:			SD:			55 - 400			Cp:					
							WEATHER:			IGN. TMP:						CORR:					
							FUNGUS:			TOX:						CAPIL:					
COMMENTS:																					
COMPANY: G.A.F.										TRADE NAME: Gaftemp											
PROD. TYPE: Urethane - Board										COMPOSITION:											
EFFECTS OF SPECIFIED CONDITION										FIRE RESISTANCE											
R	t	T	ρ	k	C	TEST	AGE:			FS:			< 75			TMP RNG: < 200			PERM: < 1.		
			2	.17		C-518	TEMP:			FC:						ABS:			1. (vol)		
						aged	MOISTURE:			SD:						Cp:					
							WEATHER:			IGN. TMP:						CORR:			none		
							FUNGUS:			TOX:						CAPIL:			low		
COMMENTS:																					
COMPANY: GENERAL PLASTICS MANUFACTURING										TRADE NAME: Last-a-Foam FR-6700											
PROD. TYPE: Urethane - Board										COMPOSITION: 95+% closed cells											
EFFECTS OF SPECIFIED CONDITION										FIRE RESISTANCE											
R	t	T	ρ	k	C	TEST	AGE:			FS:						TMP RNG: -320: 250			PERM:		
5.56	1	77	4	.18	.18	C-518	TEMP:			FC:						ABS:			7. - 22.		
5.26	1	77	6	.19	.19	C-518	MOISTURE:			SD:						Cp:			.45		
4.76	1	77	10	.21	.21	C-518	WEATHER:			IGN. TMP:			800			CORR:			none known		
3.57	1	77	20	.28	.28	C-518	FUNGUS:			TOX:						CAPIL:			low		
COMMENTS:																					
COMPANY: GREFCO										TRADE NAME: Permalite Urethane											
PROD. TYPE: Urethane - Board										COMPOSITION:											
EFFECTS OF SPECIFIED CONDITION										FIRE RESISTANCE											
R	t	T	ρ	k	C	TEST	AGE:			FS:						TMP RNG:			PERM: 2		
		75	2	.13		C-518	TEMP:			FC:						ABS:					
						init.	MOISTURE:			SD:						Cp:					
							WEATHER:			IGN. TMP:						CORR:					
							FUNGUS:			TOX:						CAPIL:					
COMMENTS: Faced with asphalt saturated felt on both sides.																					

Table 4.3.6 Rigid Insulating Boards - Polyurethane/Polyisocyanurate Foam (Continued)

COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY: LION OIL CO.										TRADE NAME: Nokorode D200 /705									
PROD. TYPE: Urethane - Board										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
				9.4	20.4*		AGE:				FS: high				PERM: < 180				
							TEMP:				FC:				ABS: 5.				
							MOISTURE:				SD: high				Cp: .7				
							WEATHER: U.V. degrades				IGN. TMP:				CORR:				
							FUNGUS:				TOX: high				CAPIL: low				
COMMENTS: Asphalt and urethane roofing material.																			
COMPANY: PANEL ERA, INC.										TRADE NAME: Insul-Roof									
PROD. TYPE: Urethane - Board										COMPOSITION: 90 - 95% closed cells. F-11B blown									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
	50	2	.14			(1)	AGE: k increases from .11 init.				FS: 35 - 45				PERM: < 200				
							TEMP: none				FC:				ABS: negligible				
							MOISTURE: small effect				SD: 200				Cp:				
							WEATHER: U.V. degrades				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX:				CAPIL:				
COMMENTS: For built up roofing. Felt facers on both sides.																			
COMPANY: PANEL ERA, INC.										TRADE NAME: Insul-Sheath									
PROD. TYPE: Urethane - Board										COMPOSITION: 90 - 95% closed cells. F-11B blown									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
	50	2	.12			(1)	AGE: none				FS: 35 - 45				PERM: < .02				
							TEMP: none				FC:				ABS: none				
							MOISTURE: small effect				SD: 100 - 200				Cp:				
							WEATHER: U.V. degrades				IGN. TMP:				CORR: none				
							FUNGUS: none				TOX:				CAPIL: none				
COMMENTS: Foil-Kraft faced. For stud wall construction.																			

NOTES: *Unconfirmed value from Reference 8.

(1) Normal K-values for aged generic material & between .15 - .18.

Table 4.3.6 Rigid Insulating Boards - Polyisocyanurate Foam (Continued)

COMPANY: THERMAL SYSTEMS, INC.							TRADE NAME: FS1000				
PROD. TYPE: Urethane-Board							COMPOSITION: 95% Closed cells				
R	t	T	c	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG: 200 : 325°F
8.69	1	70	2	.115	.115	C-177 - 76	AGE: Slight degradation in K V			FS:	PERM: 1 - 3 MVP
17.86	2	70	1.9	.112	.056	C-177 - 76	TEMP: Decomposes >350°F 1st 8-10yrs.			FC: 5 - 20	ABS: 3%
25.64	3	70	1.9	.117	.039	C-177 - 76	MOISTURE: Reduced K slightly			SD: < 450	Cp:
						Unaged	WEATHER: U.V. will oxidize surface			IGN. TMP: 650-1000°F	CORR: None
							FUNGUS:			TOX:	CAPIL: Low
COMMENTS: Available with foil, asphalt membrane or Kraft paper facings - Impermeable faced material is expected to retain K factor of about .12 upon aging.											
COMPANY: THERMAL SYSTEMS, INC.							TRADE NAME: Glas-wall finish board				
PROD. TYPE: Urethane-Board							COMPOSITION:				
R	t	T	c	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
				.12			AGE:			FS:	PERM:
				aged			TEMP:			FC:	ABS:
							MOISTURE:			SD:	Cp:
							WEATHER:			IGN. TMP:	CORR:
							FUNGUS:			TOX:	CAPIL:
COMMENTS: Urethane board faced on one side with foil and other side with fiberglass facer board. USDA approved as a sanitary finish board.											
COMPANY:							TRADE NAME:				
PROD. TYPE:							COMPOSITION:				
R	t	T	c	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
							AGE:			FS:	PERM:
							TEMP:			FC:	ABS:
							MOISTURE:			SD:	Cp:
							WEATHER:			IGN. TMP:	CORR:
							FUNGUS:			TOX:	CAPIL:
COMMENTS:											
COMPANY:							TRADE NAME:				
PROD. TYPE:							COMPOSITION:				
R	t	T	c	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
							AGE:			FS:	PERM:
							TEMP:			FC:	ABS:
							MOISTURE:			SD:	Cp:
							WEATHER:			IGN. TMP:	CORR:
							FUNGUS:			TOX:	CAPIL:
COMMENTS:											

Table 4.3.6 Rigid Insulating Boards - Polyurethane/Polyisocyanurate Foam (Concluded)

COMPANY: U.S. MINERAL PRODUCTS				TRADE NAME: Suprathane 25			
PROD. TYPE: Isocyanurate - Board				COMPOSITION: 90 - 95% closed cells			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
11.5	1.5	75	2.4	.13 .087 C-518 (1)	FS: 15	PERM:	< 250
				(not aged)	FC: 0	ABS:	
					SD: 170	Cp: .38	
					IGN. TMP:	CORR: none	
					TOX:	CAPIL: none	
COMMENTS: For steel decks and built up roofs. Glass reinforced and glass reinforced foil faced.							
COMPANY: U.S. MINERAL PRODUCTS				TRADE NAME: Suprathane Environmental Control Board			
PROD. TYPE: Urethane - Board				COMPOSITION: 90 - 95% closed cells. Flame retardant.			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
7.7	1	75	1.9	.13 .130 C-518 (1)	FS: < 75	PERM: .5	
8	1	40	1.9	.13 .125 C-518	FC:	ABS: < 3 (vol)	
5.8	3/4	75	1.9	.13 .172 C-518	SD: < 450	Cp: .38	
15.4	2	40	1.9	.13 .065 C-518	IGN. TMP:	CORR: none	
				(not aged)	TOX:	CAPIL: none	
COMMENTS: For agricultural buildings and refrigerated vehicles. Faced with Kraft reinforced foil, white on one side.							
COMPANY: U.S. MINERAL PRODUCTS				TRADE NAME: Suprathane Foil-Glass			
PROD. TYPE: Urethane - Board				COMPOSITION: 90 - 95% closed cells. Flame retardant.			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
8.3	1.1	75	2.2	.13 .12 C-518 (1)	FS:	PERM: 1.6	
				(not aged)	FC:	ABS: 1.4 (vol)	
					SD:	Cp: .38	
					IGN. TMP:	CORR: none	
					TOX:	CAPIL: none	
COMMENTS: Faced with glass reinforced foil. For roofing.							
COMPANY: WESTERN INSULFOAM				TRADE NAME: Insulthane			
PROD. TYPE: Urethane - Board				COMPOSITION:			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
		75		.12 C-518-70 (1)	FS: 25	PERM: 2.0	
				init.	FC:	ABS: .02	
					SD: 120 - 430	Cp:	
					IGN. TMP:	CORR:	
					TOX: like wood	CAPIL: low	
COMMENTS: Available with foil or asphalt saturated felt facings on both sides.							

NOTES: (1) Normal k-values for aged generic material are between .15 - .18.

Section 4.4

SPRAYED IN PLACE INSULATION

4.4.1 Cellulose	85
4.4.2 Mineral Fiber	86

Table 4.4.1 Sprayed in Place Insulation - Cellulose

COMPANY: CELLIN MANUFACTURING				TRADE NAME: Cellin Spray			
PROD. TYPE: Cellulose - Sprayed On				COMPOSITION: Cellulose and Adhesive			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG: 50 - 240
3.93	1			AGE: 3.8 .25 .25 C-177-76	FS: 20	PERM:	
				TEMP:	FC:	ABS:	
				MOISTURE:	SD: 5	Cp:	
				WEATHER:	IGN. TMP:	CORR:	none
				FUNGUS:	TOX:	CAPIL:	
COMMENTS: Available in several colors.							
COMPANY: CELLIN MANUFACTURING				TRADE NAME: Cellin Spray Thermlo - k II			
PROD. TYPE: Cellulose - Sprayed On				COMPOSITION: Cellulose and Adhesive			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:
3.7				AGE: .27	FS: 25	PERM:	
				TEMP:	FC: 0	ABS:	9.5
				MOISTURE:	SD: 10	Cp:	
				WEATHER:	IGN. TMP:	CORR:	none
				FUNGUS:	TOX:	CAPIL:	
COMMENTS: Also used without adhesive as an erosion resistant fill.							
COMPANY: THERMA-COUSTICS				TRADE NAME: TCI-75			
PROD. TYPE: Cellulose - Sprayed On				COMPOSITION:			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG: < 180
				AGE: 2.3 .19	FS: 5	PERM:	
				TEMP:	FC:	ABS:	
				MOISTURE:	SD: 0	Cp:	
				WEATHER:	IGN. TMP:	CORR:	
				FUNGUS:	TOX: none	CAPIL:	
COMMENTS:							
COMPANY: THERMO PRODUCTS COMPANY				TRADE NAME: Thermocon with Thermobond adhesive			
PROD. TYPE: Cellulose-spray on				COMPOSITION: Cellulose fiber with fine retardant			
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP	RNG:-100 : 300
				AGE: 2.5 .204	FS: 5	PERM:	
				TEMP:	FC: 10	ABS:	5.5 wt %
				MOISTURE: Little effect	SD: 0	Cp:	
				WEATHER: None	IGN. TMP:	CORR:	None
				FUNGUS: Inhibits growth	TOX: No gases gen.	CAPIL:	
COMMENTS:							

NOTES:

COMPANY: U.S. MINERAL PRODUCTS										TRADE NAME: Cafco Deck - Shield C/F									
PROD. TYPE: Mineral Fiber - Sprayed On										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
3.23	1	75	16	.31	.31	C-518	AGE: none				FS: 10				PERM:				
							TEMP: none				FC: 20				ABS:				
							MOISTURE: k increases				SD: 0				Cp: .2				
							WEATHER: requires coating				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: medium				
COMMENTS: For roofs without concrete, metal walls and structural components.																			
COMPANY: U.S. MINERAL PRODUCTS										TRADE NAME: Cafco Blaze - Shield Type 0 C/F									
PROD. TYPE: Mineral Fiber - Sprayed On										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
3.45	1	75	13	.29	.29	C-518	AGE: none				FS: 10				PERM:				
							TEMP: none				FC: 20				ABS:				
							MOISTURE: k increases				SD: 0				Cp: .2				
							WEATHER: requires coating				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: medium				
COMMENTS: For floor and ceiling assemblies, beams and columns, concrete, and general installations.																			
COMPANY: U.S. MINERAL PRODUCTS										TRADE NAME: Cafco Heat - Shield									
PROD. TYPE: Mineral Fiber - Sprayed On										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
3.85	1	75	10	.26	.26	C-518	AGE: none				FS: 10				PERM:				
							TEMP: none				FC: 20				ABS:				
							MOISTURE: k increases				SD: 0				Cp: .2				
							WEATHER: requires coating				IGN. TMP: none				CORR: none				
							FUNGUS: none				TOX: none				CAPIL: medium				
COMMENTS: For steel and concrete.																			
COMPANY: U.S. MINERAL PRODUCTS										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
							AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			

Section 4.5

FOAMED IN PLACE INSULATIONS

4.5.1 Polyurethane/Polyisocyanurate	88
4.5.2 Urea-Based Compounds	96

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate

COMPANY: COOK PAINT AND VARNISH CO.										TRADE NAME: Cloro-Foam #440											
PROD. TYPE: Isocyanurate - Froth System										COMPOSITION: 90% min. closed cells											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -100 : 250								
8.33	1	75	2	.12	.12	ASTM 518-76 initial	AGE: K increases unless faced			FS: 25			PERM: 2 - 3 perms								
						value for	TEMP: Degredation at > 250°F			FC:			ABS: .056 lb/ft ² in 48hrs.								
						K	MOISTURE: Use vapor barrier			SD: 55			Cp:								
							WEATHER: Must be protected			IGN. TMP:			CORR: None								
							FUNGUS: Resistant to growth			TOX:			CAPIL:								
COMMENTS: Dimensional stability - volume changes : 7 days @ -20°F, -1%; 7 days @ 160°F, +5%; 7 days @ 140°F and 100% RH, +7%. Uses: panel production and filling cavities.																					
COMPANY: COOK PAINT AND VARNISH CO.										TRADE NAME: Cloro-foam #415											
PROD. TYPE: Isocyanurate-Fast pour system										COMPOSITION: 90% min. closed cells											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -100 : 250								
8.33	1	75	2	.12	.12	ASTM 518-76 initial	AGE: K increases unless faced			FS: 25			PERM: 2 - 3 perms								
						value for	TEMP: Degredation at >250°F			FC:			ABS: .056 lb/ft ² in 48hrs.								
						K	MOISTURE: Use vapor barrier			SD: 55			Cp:								
							WEATHER: Must be protected			IGN. TMP:			CORR: None								
							FUNGUS: Resistant to growth			TOX:			CAPIL:								
COMMENTS: For production of continuous laminated board and panels with various skins.																					
COMPANY: COOK PAINT AND VARNISH CO.										TRADE NAME: Cloro-foam G-325											
PROD. TYPE: Isocyanurate-spray in place										COMPOSITION: 90% min. closed cells											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -100 : 250								
8.33	1	75	2	.12	.12	ASTM 518-76 initial	AGE: K increases to .16 unless faced			FS: 30			PERM: 2 - 3 perms								
						value for	TEMP: Degredation at >250°F			FC:			ABS: .056 lb/ft ² in 48 hrs.								
						K	MOISTURE: Use vapor barrier			SD: 185			Cp:								
							WEATHER: Must be protected			IGN. TMP:			CORR: None								
							FUNGUS: Resistant to growth			TOX:			CAPIL:								
COMMENTS:																					
COMPANY:										TRADE NAME:											
PROD. TYPE:										COMPOSITION:											
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:								
							AGE:			FS:			PERM:								
							TEMP:			FC:			ABS:								
							MOISTURE:			SD:			Cp:								
							WEATHER:			IGN. TMP:			CORR:								
							FUNGUS:			TOX:			CAPIL:								
COMMENTS:																					

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Continued)

COOK PAINT AND VARNISH CO.										TRADE NAME: See comments	
COMPANY:		Urethane - Foamed in place								COMPOSITION: 90% closed cells	
PROD. TYPE:		Urethane		Foamed in place		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE	
R	t	T	ρ	k	C	TEST	AGE:	TEMP:	MOISTURE:	WEATHER:	TMP RNG:
7.7		75	2	.13		(1)				FS: 25	PERM: 1 - 3
6.3		150	2	.16						FC: 150 - 250	ABS: none
										SD: 150 - 250	Cp: none
										IGN. TMP:	CORR: low
										TOX:	CAPIL:
COMMENTS: Urethane odor during application. Trade names: Corofoams #403 and #405 Froth, #406 Pour, and G-389 Spray. (1978 information)											
CPR DIVISION, THE UPJOHN CO.										TRADE NAME: Isonate	
COMPANY:		Urethane - Foamed in place								COMPOSITION:	
PROD. TYPE:		Urethane		Foamed in place		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE	
R	t	T	ρ	k	C	TEST	AGE:	TEMP:	MOISTURE:	WEATHER:	TMP RNG:
		75	2	.14		(1)				FS: 25	PERM:
										FC: 15	ABS:
										SD: 400	Cp:
										IGN. TMP:	CORR:
										TOX:	CAPIL:
COMMENTS:											
INSTA FOAM PRODUCTS										TRADE NAME: Froth Pak	
COMPANY:		Urethane - foamed in place								COMPOSITION: 80% closed cells	
PROD. TYPE:		Urethane		Foamed in place		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE	
R	t	T	ρ	k	C	TEST	AGE:	TEMP:	MOISTURE:	WEATHER:	TMP RNG:
6.25	1	75	1	.16	.15	(1)				FS: 225	PERM:
										FC: 225	ABS:
										SD: 225	Cp:
										IGN. TMP:	CORR: none
										TOX:	CAPIL:
COMMENTS:											
TRADE NAME:										COMPOSITION:	
PROD. TYPE:		Urethane		Foamed in place		EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE	
R	t	T	ρ	k	C	TEST	AGE:	TEMP:	MOISTURE:	WEATHER:	TMP RNG:
										FS: 225	PERM:
										FC: 225	ABS:
										SD: 225	Cp:
										IGN. TMP:	CORR: none
										TOX:	CAPIL:
COMMENTS:											

NOTES: (1) Normal aged k-values for generic material: .15 - .18.

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Continued)

COMPANY: INSTA FOAM PRODUCTS				TRADE NAME: Froth Pak	
PROD. TYPE: Urethane - Foamed in place				COMPOSITION: 90+% closed cells	
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
7.14	1	75	1.75 .14 .14 (1)	AGE:	FS: < 250
				TEMP:	PERM: 2
				MOISTURE:	ABS: 2
				WEATHER: U.V. degrades	Cp: none
				FUNGUS: none	CORR: none
				TOX:	CAPIL:
COMMENTS:					
COMPANY: NORTH AMERICAN COMPOUNDING				TRADE NAME: NB 45	
PROD. TYPE: Urethane - Foamed in place				COMPOSITION: 97% closed cells	
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
			2.0 .11 initial	AGE:	FS: 1.8
				TEMP: dimensions may change with	PERM:
				MOISTURE: high temp. & moisture	ABS:
				WEATHER:	Cp:
				FUNGUS:	CORR:
				TOX:	CAPIL:
COMMENTS: For both warm and cold weather use.					
COMPANY: NORTH AMERICAN COMPOUNDING				TRADE NAME: HD-3	
PROD. TYPE: Urethane - Foamed in place				COMPOSITION: 90% closed cells	
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
			2.8 .16 aged	AGE:	FS: < 165
				TEMP: dimensions may change with	PERM:
				MOISTURE: high temp. & moisture	ABS:
				WEATHER:	Cp:
				FUNGUS:	CORR:
				TOX:	CAPIL:
COMMENTS: For roof decks, U.L. Class A fire rated.					
COMPANY: OLIN				TRADE NAME: Thermolin RF-230 and Autofroth	
PROD. TYPE: Urethane - Foamed in place				COMPOSITION:	
R	t	T	C	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE
		75	.18	AGE:	FS: < 250
				TEMP:	PERM:
				MOISTURE:	ABS:
				WEATHER:	Cp:
				FUNGUS:	CORR:
				TOX:	CAPIL:
COMMENTS: Meets Class I or Class II fire requirements.					

NOTE: (1) Normal aged k-values for generic material: .15 - .18.

AD-A082 737

DYNATECH R/D CO CAMBRIDGE MASS
BUILDING INSULATION MATERIALS COMPILATION. (U)
SEP 79 J G BOURNE, D L BROWNELL, E C GUYER

F/G 13/13

UNCLASSIFIED

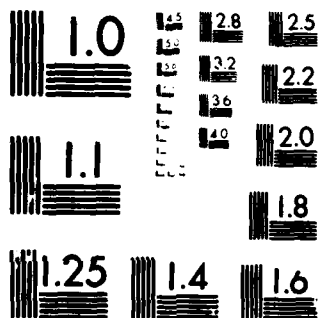
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Continued)

COMPANY: POLYMER DEVELOPMENT LABORATORIES, INC.										TRADE NAME: PDL 310-2									
PROD. TYPE: Urethane-Pour in place										COMPOSITION: >92% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
7.1	1		2	.14	.14	AGE:					FS: < 25				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS: UBC Class I, NFPA Class A; Densities available from 1.5 to 40 lb/ft ³																			
COMPANY: POLYMER DEVELOPMENT LABORATORIES, INC.										TRADE NAME: PDL 110-2									
PROD. TYPE: Urethane-Spray in place										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
6.7	1		2	.15	.15	AGE:					FS:				PERM:				
				aged		TEMP: 3.5% increase in volume for					FC:				ABS:				
						MOISTURE: 1 wk @ 100°F & 100% RH					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				
						TEMP:					FC:				ABS:				
						MOISTURE:					SD:				Cp:				
						WEATHER:					IGN. TMP:				CORR:				
						FUNGUS:					TOX:				CAPIL:				
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG:				
						AGE:					FS:				PERM:				

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Continued)

COMPANY: REICHOOLD CHEMICALS										TRADE NAME: Polylyte 34-733/34-843									
PROD. TYPE: Urethane - Foamed in place										COMPOSITION: 93% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 250				
			2	.15			AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY: REICHOOLD CHEMICALS										TRADE NAME: Polylyte 90-685/90-684									
PROD. TYPE: Urethane - Foamed in place										COMPOSITION: 94% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 200				
			2				AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:																			
COMPANY: REICHOOLD CHEMICALS										TRADE NAME: Polylytes 98-343/34-841									
PROD. TYPE: Urethane - Foamed in place										COMPOSITION: 93% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 200				
			2	.15			AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:										For low temperatures and roofing.									
COMPANY: REICHOOLD CHEMICALS										TRADE NAME: Polylytes 90-620/34-681									
PROD. TYPE: Urethane - Foamed in place										COMPOSITION: 95% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION				FIRE RESISTANCE				TMP RNG: < 180				
			3	.14			AGE:				FS:				PERM:				
							TEMP:				FC:				ABS:				
							MOISTURE:				SD:				Cp:				
							WEATHER:				IGN. TMP:				CORR:				
							FUNGUS:				TOX:				CAPIL:				
COMMENTS:										For low temperatures and roofing.									

NOTES:

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Continued)

COMPANY: REICHOLD CHEMICALS				TRADE NAME: Polyrites 90-670/90-654					
PROD. TYPE: Isocyanurate - Foamed in place				COMPOSITION: 95% closed cells					
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:
			2.3	.16			AGE:	FS:	PERM:
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For high temperaure and industrial applications.									
COMPANY: REICHOLD CHEMICALS				TRADE NAME: Polyrites 98-137/34-841					
PROD. TYPE: Urethane - Foamed in place				COMPOSITION: 93% closed cells					
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG: < 180
			3	.14			AGE:	FS:	PERM: .15
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For roofing and warm weather applications.									
COMPANY: REICHOLD CHEMICALS				TRADE NAME: Polyrites 34-732/34-842					
PROD. TYPE: Urethane - Foamed in place				COMPOSITION: 93% closed cells					
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG: < 250
			2	.15			AGE:	FS:	PERM:
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For low temperatures.									
COMPANY: REICHOLD CHEMICALS				TRADE NAME: Polyrites 34-733/34-846					
PROD. TYPE: Urethane - Foamed in place				COMPOSITION: 93% closed cells					
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG: < 200
			2	.15			AGE:	FS:	PERM:
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For low temperatures and roofing.									

NOTES:

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Continued)

COMPANY: REICHOID CHEMICALS										TRADE NAME: Polylires 90-666/34-842									
PROD. TYPE: Urethane - Foamed in place										COMPOSITION: 94% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: < 180						
			2	.13		(1)	AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS: For low temperatures and roofing.																			
COMPANY: STEPAN CHEMICAL										TRADE NAME: Stepanfoam R253 BU									
PROD. TYPE: Urethane - isocyanurate foamed in place										COMPOSITION: > 90% closed cells, F-11 blown									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -40: 250						
8.3	1	75	2	.12	.12	C-177 (1)	AGE:			FS: 30			PERM:						
							TEMP:			FC: 0			ABS:						
							MOISTURE:			SD: 210			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY: STEPAN CHEMICAL										TRADE NAME: Stepanfoam R 262 X									
PROD. TYPE: Urethane - isocyanurate - foamed in place										COMPOSITION: closed cells > 90%, F-11 blown									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -40: 250						
8.3	1	75	2.4	.12	.12	C-177 (1)	AGE:			FS: 25			PERM:						
							TEMP:			FC: 0			ABS: 3 (vol)						
							MOISTURE:			SD: 237			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY: TEXAS URETHANES										TRADE NAME: Texthane 220-20									
PROD. TYPE: Urethane - foamed in place										COMPOSITION: 90+% closed cells									
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -320:200						
				.15		estimated	AGE:			FS: 20			PERM: 1 - 2						
						(1)	TEMP:			FC: 0			ABS: < .025 (vol)						
							MOISTURE:			SD: 200			Cp:						
							WEATHER:			IGN. TMP:			CORR: unprimed metal						
							FUNGUS:			TOX:			CAPIL: none						
COMMENTS: Amine odor during application.																			

NOTES: (1) Normal aged k-values for generic material: .15 - .18.

Table 4.5.1 Foamed in Place - Polyurethane/Polyisocyanurate (Concluded)

COMPANY: UNITED FOAM CORP.									
PROD. TYPE: Urethane - Foamed in place					TRADE NAME: UFC-420 UFC-115				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNC: -100: 250
7.68	1		2-3	.13	.13	C-177	AGE: none	FS: 75	PERM: 2
							TEMP: none	FC: 10	ABS:
							MOISTURE: none	SD: 450	Cp:
							WEATHER: not exposed	IGN. TMP:	CORR: none
							FUNGUS: none	TOX: like wood	CAPIL: none
COMMENTS: Odor during application. K-factor is initial.									
COMPANY: UNITED FOAM CORP.									
PROD. TYPE: Urethane - Foamed in place					TRADE NAME: UFC-250, UFC 450				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNC: -100: 250
7.68	1		2-3	.13	.13	C-177	AGE: none	FS: 25	PERM: 2
							TEMP: none	FC: 10	ABS:
							MOISTURE: none	SD: 450	Cp:
							WEATHER: not exposed	IGN. TMP:	CORR: none
							FUNGUS: none	TOX: like wood	CAPIL: none
COMMENTS: Odor during application. K-factor is initial.									
COMPANY: URETHANE SYSTEMS CORP.									
PROD. TYPE: Urethane - Foamed in place					TRADE NAME:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNC:
				.14		(2)	AGE: none	FS: 25	PERM: .2
							TEMP:	FC:	ABS: .06 (vol)
							MOISTURE: degrades	SD:	Cp:
							WEATHER: degrades	IGN. TMP:	CORR: when liquid
							FUNGUS: none	TOX:	CAPIL:
COMMENTS: Mild odor.									
COMPANY: WITCO CHEMICAL									
PROD. TYPE: Urethane - Foamed in place					TRADE NAME: Isofoam - see below				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNC: -300: 200
4.5	.5	75	1.7	.11	.22	C-518	AGE: k increases	FS: 20 - 200	PERM: 1 - 4
3.1			3.0	.16	.32		TEMP: k, volume can increase	FC: 0 - 10	ABS: 2 - 4 (vol)
							MOISTURE: k, volume can increase	SD: 100 - 700	Cp:
							WEATHER: U.V. degrades	IGN. TMP: 700	CORR: Yes (1)
							FUNGUS: none	TOX:	CAPIL: none
COMMENTS: Includes Isofoams # SS-0731, SS-0732, SS-0501, SS-0545, R-0380, R-0752. Mild odor during installation.									

NOTES:

- (1) Can corrode steel and aluminum in the presence of moisture and heat.
- (2) Normal aged k-values for generic material: .15 - .18.

Table 4.5.2 Foamed in Place Insulations - Urea-Based Compounds

COMPANY: AEROLITE SPE CORP.										TRADE NAME: Aerolite	
PROD. TYPE: Urea-formaldehyde - foamed in place										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
4.55	1	75	.86	.22	.22	C-518	AGE:	3 - 6.5% shrinkage		FS: 25	PERM: 20.1
4.8	1	32	.86	.21	.21	C-518	TEMP:	none		FC: 0	ABS: 2.
							MOISTURE:	none		SD: 125 - 200	Cp:
							WEATHER:	none		IGN. TMP: 1150	CORR: none
							FUNGUS:	none		TOX: < wood	CAPIL: none
COMMENTS: Formaldehyde odor present during curing.											
COMPANY: RAPCO FOAM, INC.										TRADE NAME: Rapco Foam	
PROD. TYPE: Urea-formaldehyde - foamed in place										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
16.8	3.5	35	.87	.21	.060	C-177-76	AGE:	3 to 6% shrinkage		FS: 10	PERM: 9.6
15.2	3.5	70	.87	.23	.066	C-177-76	TEMP: High temp. and humidity may			FC: 0	ABS: 3 (vol)
							MOISTURE: cause hydrolysis			SD: 35	Cp:
							WEATHER: U.V. degrades			IGN. TMP: 1200	CORR: none
							FUNGUS: none			TOX: < wood	CAPIL:
COMMENTS: Formaldehyde odor 2 days to 2 weeks after installation.											
COMPANY: RAPCO FOAM, INC.										TRADE NAME: Rapco II	
PROD. TYPE: Urea-formaldehyde - foamed in place										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
7.0	1.6	35	.84	.23	.14	C-177-76	AGE:	.8% shrinkage		FS: 20	PERM: 9.6
6.6	1.6	75	.84	.24	.15	C-177-76	TEMP: High temp. and humidity may			FC: 0	ABS: 3 (vol)
							MOISTURE: cause hydrolysis			SD: 30 - 70	Cp:
							WEATHER: U.V. degrades			IGN. TMP: 1200	CORR: none
							FUNGUS: none			TOX:	CAPIL:
COMMENTS: Low shrinkage foam. Formaldehyde odor 2 days to 2 weeks after installation.											
COMPANY:										TRADE NAME:	
PROD. TYPE:										COMPOSITION:	
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE	TMP RNG:
							AGE:			FS:	PERM:
							TEMP:			FC:	ABS:
							MOISTURE:			SD:	Cp:
							WEATHER:			IGN. TMP:	CORR:
							FUNGUS:			TOX:	CAPIL:
COMMENTS:											

NOTES:

Section 4.6
REFLECTIVE SURFACES

The following companies are manufacturers of reflective foil insulation:

Foilpleat Insulation Company
246 Second Street
Fall River, Massachusetts 02721

Howmet Aluminum Corp.
475 Steamboat Road
Greenwich, Connecticut 06831

Infra Insulation Mfg., Company
408 Rialto
San Bernardino, California 92401

Martin-Walker, Inc.
P. O. Box 151
Rapho Industrial Park
Mt. Joy, PA 17552

Roy & Sons, Inc.
10533 Valley Boulevard
El Monte, California 91731

Section 4.7

SPECIAL INSULATIONS

Table 4.7 Special Insulations

COMPANY: HEXCEL										TRADE NAME: Hexcel Honeycomb									
PROD. TYPE: Honeycomb - Board										COMPOSITION: Sandwiched Honeycomb									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: < 350						
		75	2	.3-			AGE:			FS: 15			PERM:						
				.9			TEMP:			FC:			ABS: 6.						
							MOISTURE: degrades strength			SD: 25 - 40			Cp:						
							WEATHER:			IGN. TMP:			CORR: see below						
							FUNGUS: resistant			TOX:			CAPIL: yes						
COMMENTS: Constructed of Kraft paper. Available with flame retardant, which may be corrosive.																			
COMPANY: SILBRICO CORP.										TRADE NAME: All-Weather Crete									
PROD. TYPE: Perlite and Asphalt-Form in Place										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG: -30: 600						
			22	.4		C-177	AGE: none			FS:			PERM:						
							TEMP: none			FC:			ABS: 4.5						
							MOISTURE: k increases			SD:			Cp: .36						
							WEATHER: none			IGN. TMP:			CORR: none						
							FUNGUS: none			TOX:			CAPIL: low						
COMMENTS: For roofs and plaza decks.																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			
COMPANY:										TRADE NAME:									
PROD. TYPE:										COMPOSITION:									
R	t	T	p	k	C	TEST	EFFECTS OF SPECIFIED CONDITION			FIRE RESISTANCE			TMP RNG:						
							AGE:			FS:			PERM:						
							TEMP:			FC:			ABS:						
							MOISTURE:			SD:			Cp:						
							WEATHER:			IGN. TMP:			CORR:						
							FUNGUS:			TOX:			CAPIL:						
COMMENTS:																			

NOTES:

Section 4.8
VAPOR BARRIERS

Table 4.8 vapor Barriers

COMPANY:		ST. REGIS		TRADE NAME:		Orange Label Sisalkraft			
PROD. TYPE:		Vapor barrier		COMPOSITION:		Glass reinforced asphalt and Kraft			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RRG:
							AGE:	FS:	.18 (E-96)
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For use as a concrete curing paper.									
COMPANY:		ST. REGIS		TRADE NAME:		Moistop 395			
PROD. TYPE:		Vapor barrier		COMPOSITION:		Glass reinforced polyethylene and Kraft			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RRG:
							AGE:	FS:	.15 (E-96)
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For use as an underslab vapor barrier.									
COMPANY:		ST. REGIS		TRADE NAME:		Vaporstop			
PROD. TYPE:		Vapor barrier		COMPOSITION:		Glass reinforced asphalt and Kraft			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RRG:
							AGE:	FS:	.23 (E-96)
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For use as a roof deck vapor barrier.									
COMPANY:		ST. REGIS		TRADE NAME:		Pyro-kutz 600			
PROD. TYPE:		Vapor barrier		COMPOSITION:		Glass reinforced Kraft and adhesive			
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RRG:
							AGE:	FS:	.25 (E-96)
							TEMP:	FC:	ABS:
							MOISTURE:	SD:	Cp:
							WEATHER:	IGN. TMP:	CORR:
							FUNGUS:	TOX:	CAPIL:
COMMENTS: For use as a roof deck vapor barrier. Adhesive is flame extinguishing.									

NOTES:

Table 4.8 Vapor Barriers (Concluded)

COMPANY: STAUFFER CHEMICAL							TRADE NAME: Ultrafilm Atlas - 96				
PROD. TYPE: Vapor barrier							COMPOSITION:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:		
		.0032					AGE:	FS: 15	PERM:	1.0 (E-96)	
							TEMP:	FC:	ABS:		
							MOISTURE:	SD: 105	Cp:		
							WEATHER:	IGN. TMP:	CORR:		
							FUNGUS:	TOX:	CAPIL:		
COMMENTS:											
COMPANY: STAUFFER CHEMICAL							TRADE NAME: Atlas - LP				
PROD. TYPE: Vapor barrier							COMPOSITION:				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:		
		.0032					AGE:	FS: 15	PERM:	.26 (E-96)	
							TEMP:	FC:	ABS:		
							MOISTURE:	SD: 45	Cp:		
							WEATHER:	IGN. TMP:	CORR:		
							FUNGUS:	TOX:	CAPIL:		
COMMENTS:											
COMPANY: STAUFFER CHEMICAL							TRADE NAME: URF - 10007 Ultralam				
PROD. TYPE: Vapor barrier							COMPOSITION: Glass reinforced vinyl and foil				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:		
							AGE:	FS: 20	PERM:	.02 (E-96)	
							TEMP:	FC: 0	ABS:		
							MOISTURE: no delamination	SD: 10	Cp:		
							WEATHER: none	IGN. TMP:	CORR:		
							FUNGUS:	TOX:	CAPIL:		
COMMENTS:											
COMPANY: STAUFFER CHEMICAL							TRADE NAME: URP-3				
PROD. TYPE: Vapor barrier							COMPOSITION: Fiberglass, PVC and metallized polystyrene				
R	t	T	ρ	k	C	TEST	EFFECTS OF SPECIFIED CONDITION	FIRE RESISTANCE	TMP RNG:		
							AGE:	FS: 15	PERM:	.05 (E-96)	
							TEMP:	FC: 0	ABS:		
							MOISTURE: no delamination	SD: 50	Cp:		
							WEATHER: none	IGN. TMP:	CORR:		
							FUNGUS:	TOX:	CAPIL:		
COMMENTS:											

NOTES:

Section 5

REFERENCES

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Appendix A
CONVERSION FACTOR TABLES

Length

<u>inch</u>	<u>foot</u>	<u>centimeter</u>	<u>meter</u>
1	0.083333	2.5400	0.025400
12	1	30.480	0.30480
0.39370	0.032808	1	0.01
39.370	3.2808	100	1

Area

<u>inch²</u>	<u>foot²</u>	<u>centimeter²</u>	<u>meter²</u>
1	6.9444E-3	6.4516	6.4516E-4
144	1	929.03	0.092903
0.15500	1.0763E-3	1	0.0001
1550.0	10.763	10000	1

Volume

<u>inch³</u>	<u>foot³</u>	<u>centimeter³</u>	<u>meter³</u>
1	5.787E-4	16.387	1.6387E-5
1728	1	28317	0.028317
0.061023	3.5315E-5	1	1E-6
61023	35.315	1E6	1

Mass

<u>lbm</u>	<u>kg</u>
1	0.45359
2.2046	1

Density

<u>lb/ft³</u>	<u>g/cm³</u>	<u>kg/m³ = (g/liter)</u>
1	0.016018	16.018
62.428	1	1000.
0.062428	0.001	1

Temperature

<u>scales</u>	<u>differences</u>
$F = 1.8C + 32$	$1F = 0.555556C$
$C = (F - 32) \cdot 5/9$	$1C = 1.8F$
$K = C + 273$	
$R = F + 460$	

Pressure

<u>lb/in²</u>	<u>atm.</u>	<u>mm Hg</u>	<u>Pa</u>
1	0.068046	51.715	6894.8
14.696	1	760.0	101325.
0.019337	1.3158E-3	1	133.32
1.4503E-4	9.8692E-6	7.50E-3	1

Thermal Conductivity

<u>BTU-in</u> <u>hrft²°F</u>	<u>BTU</u> <u>hrft °F</u>	<u>W</u> <u>m K</u>	<u>cal</u> <u>sec cm K</u>	<u>kcal</u> <u>hr m K</u>
1	0.083333	0.14423	3.4448E-4	0.12410
12	1	1.7307	4.1379E-3	1.4892
6.9335	0.57779	1	2.3885E-3	0.86042
2902.9	241.91	418.4	1	360.00
8.0582	0.67152	1.1622	2.7759E-3	1

Thermal Conductance/Heat Transfer Coefficient

<u>BTU</u> <u>hrft²°F</u>	<u>W</u> <u>m²K</u>	<u>kcal</u> <u>hrm²K</u>	<u>cal</u> <u>seccm²K</u>
1	5.6783	4.8858	1.3571E-4
0.17611	1	0.86044	2.3900E-5
0.20468	1.1622	1	2.7777E-5
7368.6	4.1841E4	3.6001E4	1

Thermal Resistance

$\frac{\text{hrft}^2\text{°F}}{\text{BTU}}$	$\frac{\text{m}^2\text{K}}{\text{W}}$	$\frac{\text{hrm}^2\text{K}}{\text{kcal}}$	$\frac{\text{seccm}^2\text{K}}{\text{cal}}$
1	0.17611	0.20468	7368.6
5.6783	1	1.1622	4.1841E4
4.8858	0.86044	1	3.6001E4
1.3571E-4	2.3900E-5	2.7777E-5	1

Thermal Resistivity

$\frac{\text{hrft °F}}{\text{BTU-in}}$	$\frac{\text{hrft °F}}{\text{BTU}}$	$\frac{\text{m K}}{\text{W}}$	$\frac{\text{seccmK}}{\text{cal}}$	$\frac{\text{hr m K}}{\text{kcal}}$
1	12	6.9335	2902.9	8.0582
0.083333	1	0.57779	241.91	0.67152
0.14423	1.7307	1	418.4	1.1622
3.4448E-4	4.1379E-3	2.3885E-3	1	2.7759E-3
0.12410	1.4892	0.86042	360.00	1

Heat Flux

\dot{Q}		\dot{Q}/A	
$\frac{\text{BTU}}{\text{hr}}$	W	$\frac{\text{BTU}}{\text{hrft}^2}$	$\frac{\text{W}}{\text{m}^2}$
1	0.29307	1	3.1545
3.4122	1	0.31700	1

Specific Heat

$\frac{\text{BTU}}{\text{lb °F}}$	$=$	$\frac{\text{cal}}{\text{g K}}$	$\frac{\text{kJ}}{\text{kgK}}$
1			4.187
0.2388			1

Water Vapor Permeability

$\frac{\text{grain}}{\text{hrft}^2\text{-in-Hg}}$	$\frac{\text{kg}}{\text{Pa s m}^2}$
1	5.7453 E-11
1.7406E + 10	1

Appendix B

MATERIAL SPECIFICATIONS AND TESTING STANDARDS FOR BUILDING INSULATIONS

B.1 Specification and Title for Building Insulation

HH-B-00100	Vapor (barrier material) for fire retardant reinforced for pipe and duct insulation
HH-C-561	Cork; compressed (corkboard) (for thermal insulation)
HH-I-521	Insulation blankets, thermal (mineral fiber, for ambient temperatures)
HH-I-515	Insulation blanket, thermal-acoustical, and insulation thermal, vegetable or wood fiber
HH-I-524	Insulation board, thermal (Polystyrene)
HH-I-530	Insulation board, thermal (Urethane)
HH-I-545	Insulation, thermal and acoustical (mineral fiber, duct lining material)
HH-I-550	Insulation sleeving, thermal (Urethane)
HH-I-551	Insulation board and block (cellular glass)
HH-I-558	Insulation, blocks, boards, blankets, felts, sleeving (pipe and tube covering), and pipe fitting covering, thermal (mineral fiber, industrial type)
HH-I-574	Insulation, loose fill (Perlite)
HH-I-585	Insulation, thermal (Vermiculite)
HH-I-1030	Insulation, thermal (mineral fiber, for pneumatic or poured application)
HH-I-1252	Insulation, thermal, reflective (aluminum foil)
MIL-I-535	Insulation board and block, thermal
MIL-I-742	Insulation board, thermal, fibrous glass
MIL-I-2818	Insulation blanket, thermal, fibrous mineral
MIL-I-2819	Insulation block, thermal
MIL-I-15475	Insulation felt, thermal, fibrous glass semi-rigid
MIL-I-22023	Insulation felt, thermal and sound absorbing felt, fibrous glass, flexible

MIL-I-23128	Insulation, blanket, thermal, refractory fiber, flexible
Maritime No. 32-MA-1e	Insulation: mineral fiber, blanket type (3 - 8 pounds per cubic foot)
Maritime No. 32-MA-3c	Insulation: felt fibrous glass
C195	Mineral fiber thermal insulating cement
C196	Expanded or exfoliated vermiculite thermal insulating cement
C197	Diatomaceous silica thermal insulating cement
C208	Insulating board (cellulose fiber), structural and decorative
C236	Thermal insulation, reflecting (aluminum), pending
C262	Mineral fiber batt insulation (industrial type)
C516	Vermiculite loose fill insulation
C517	Diatomaceous earth block and pipe thermal insulation
C549	Perlite loose fill insulation
C552	Cellular glass block and pipe insulation
C553	Mineral fiber blanket and felt insulation (industrial type)
C610	Expanded perlite block and pipe thermal insulation
C612	Mineral fiber block and board insulation
C640	Corkboard and cork pipe insulation for low temperature thermal insulation
C665	Mineral fiber blanket thermal insulation for wood frame and light construction buildings
C726	Mineral fiber roof insulation board
C728	Perlite thermal insulation board
C764	Mineral fiber loose fill thermal insulation
C739	Cellulosic fiber (wood base) loose fill thermal insulation
C578	Preformed, block-type cellular polystyrene thermal insulation

C591	Rigid preformed cellular urethane thermal insulation
C532	Structural insulating formboard (cellulosic fiber)
Maritime No. 32-MA-4b	Plastic material thermal, cellular, rigid (urethane)

B.2 ASTM Standard and Title by Test Classification

Classification 1: Measurement of Thermal Properties

C177	Steady State Thermal Transmission Properties by means of the Guarded Hot Plate
C518	Steady State Thermal Transmission Properties by means of the Heat Flow Meter
C236	Thermal Conductance and Transmittance of Built-up Sections by means of the Guarded Hot Box
C653	Recommended Practice for Determination of Thermal Resistance of Low Density Mineral Fiber Blanket-Type Building Insulation
C687	Recommended Practice for Determination of Thermal Resistance of Low Density Fibrous Loose Fill Type Building Insulation

Classification 2: Measurement of Dimension, Stability and Density Properties

C167	Tests for Thickness and Density of Blanket or Batt Type Thermal Insulating Materials
C303	Test for Density of Preformed Block Type Thermal Insulation
C519	Test for Density of Fibrous Loose Fill Building Insulations
C520	Test for Density of Granular Loose Fill Insulations
C1622	Test for Apparent Density of Rigid Cellular Plastics
C355	Test for Water Vapor Transmission of Thick Materials
D2842	Test for Water Absorption of Rigid Cellular Plastics

- D2126 Test for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- D591 Test for Starch in Paper
- C272 Test for Water Absorption of Core Materials for Structural Sandwich Constructions
- D756 Tests for Resistance of Plastics to Accelerated Service Conditions
- D1204 Measuring Changes in Linear Dimensions of Non Rigid Thermoplastic Sheeting or Film
- C447 Recommended Practice for Estimating the Maximum Use of Temperature of Preformed Homogeneous Thermal Insulation

Classification 3: Measurement of Strength Properties

- C165 Test for Comprehensive Strength of Preformed Block Type Thermal Insulation
- C686 Test for Parting Strength of Mineral Fiber Batt and Blanket Type Insulation
- D1621 Test for Compressive Properties of Rigid Cellular Plastics
- D1623 Test for Tensile Properties of Rigid Cellular Plastics
- D781 Test for Puncture and Stiffness of Paperboard Corrugated and Solid Fiberboard
- C209 Testing Insulating Board (Cellulosic Fiber) Structural and Decorative
- D882 Test for Tensile Properties of Thin Plastic Sheeting

Classification 4: Measurement of Fire Properties

- E84 Standard Method of Test for Surface Burning Characteristics of Building Materials
- E136 Tests for Noncombustibility of Elementary Materials

Classification 5: Measurement of Properties of Vapor Barriers

- C677 Recommended Practice for Use of a Standard Reference Sheet for the Measurement of the Time-Averaged Vapor Pressure in a Controlled Humidity Space

E96	Tests for Water Vapor Transmission of Materials in Sheet Form
C755	Recommended Practice for Selection of Vapor Barriers for Thermal Insulation
D2020	Test for Mildew Resistance of Paper and Paperboard
C445	Test for Normal Total Emittance of Surfaces of Materials 0.01 inch or Less in Thickness at Approximately Room Temperature
D777	Test for Flammability of Treated Paper and Paperboard

Appendix C

METHODS USED TO COMPILE DATA

The primary sources of detailed information used in the compilation were the responses of insulation manufacturers to the questionnaire entitled "SURVEY OF BUILDING INSULATION MATERIAL PROPERTIES" (see sample following).

This survey was sent to over 550 manufacturers of various types of insulation throughout the United States. Approximately 10 percent of these manufacturers returned information which was suitable for use in this compilation either directly to the questionnaire or to following telephone calls.

If there was no response to this questionnaire, data from a previous Dynatech survey on a similar topic were included in this compilation, although this information was far less detailed than that provided in the current questionnaire. Where permission was granted by the manufacturers, data were obtained from the Thermatest Measurements Department of Dynatech for products tested at that facility.

The Navy Civil Engineering Laboratory has earlier issued a catalog entitled "Construction Material Catalog for Building Energy Conservation". When a company from this catalog had not responded to either of Dynatech's surveys, the data from this source were incorporated in the compilation.

Data for the generic insulation properties section was obtained from standard references such as the 1977 ASHRAE Handbook of Fundamentals. In addition, plots or other data were sometimes taken from the manufacturers literature, and these are noted as such.

SURVEY OF BUILDING INSULATION MATERIAL PROPERTIES

The Naval Civil Engineering Laboratory is sponsoring the development of a comprehensive compilation of building insulation materials. The compilation will be used by both military and civilian agencies of the government as a source-book for determining the materials and manufacturers which meet their purchasing specifications.

This questionnaire has been sent to you to provide a means for your company and insulating products to be included in the compilation. If you have technical reports available for some types of insulating products which supply most of the data requested in the survey, please complete the remaining unanswered questions and return both the technical reports and the completed survey.

Your complete and accurate response to this questionnaire will ensure that your company will be fully represented in the compilation.

Company Name: _____

Company Address: _____

(Street)

(City)

(State)

(Zip)

Name and title of person who should be contacted
if questions should arise regarding this survey:

Telephone Number:

INSTRUCTIONS:

Please prepare and return one (1) copy of this survey and two (2) copies of your marketing literature for each product manufactured to:

Mr. James G. Bourne, Manager
Dynatech R/D Company - Thermal Engineering Dept.
99 Erie Street
Cambridge, MA 02139
(617) 868-8050

Please indicate, where relevant, if information supplied has been generated internally, verified independently, or estimated.

- If information is not provided because it is proprietary, please so state.
- If any question is not applicable to your product, please enter N/A.
- If data are not available, please so state.
- If more space is necessary, please attach additional pages.

Additional copies of this survey form are available on request from the above address.
Thank you for your cooperation and assistance in supplying information about your line of products for this compilation.

I. PRODUCT DESCRIPTION

1. Briefly describe this product (type of insulation, trade name, recommended applications, etc.)
2. Specify the composition and form of this product. Please indicate, where applicable, closed cell content, blowing agent, fiber size, shot content, flame retardant and concentration, and any other pertinent information.

II. GENERAL INFORMATION

1. What is the specific heat of this product (BTU/lb_m °F) _____
2. Do you recommend the use of a vapor barrier in conjunction with this product? _____
If so, what?
3. What is the permeability to water vapor of this product? (Perm-in)
4. What is the permeability to air of this product? (Specify units)
5. Once installed, what is the water absorption capacity of this product? (Wt% and/or Vol%)
6. In qualitative terms, what is the capillarity of this product? (High, medium, low, none)
7. What are the odor characteristics of this product, both during installation and while in service?
8. Does this product tend to accelerate the corrosion of other materials? _____
If yes, specify the material(s) corroded, degree of corrosiveness and the required conditions for corrosion to occur.
9. What is the recommended range of temperatures over which this product may be used? (°F)

III. PERFORMANCE CHARACTERISTICS

Please provide the information requested in the table below, for each standard thickness of insulation you manufacture for which test data are available. If the thickness of the insulation is not standardized (as in blown-in-place insulation), then supply the information for each thickness that has been tested.

Test Method Used to Determine Thermal Resistance	Temp. Conditions of the Test Hot/Cold Face T (°F)	Thickness t (in.)	Thermal Resistance R ($\text{ft}^2 \text{hr}^\circ\text{F}/\text{BTU}$)	Apparent Thermal Conductivity k ($\text{BTU-in}/\text{ft}^2 \text{hr}^\circ\text{F}$)	Thermal Conductance C ($\text{BTU}/\text{ft}^2 \text{hr}^\circ\text{F}$)	Density (lb_m/ft^3)	Comments

IV. EFFECT OF AGING AND ENVIRONMENTAL CONDITIONS ON THE PROPERTIES OF THIS PRODUCT

1. What is the realistic expected lifetime of this product (years)? _____
2. Please indicate in the table below the beneficial or degrading effects of the specified conditions on the properties of this product.

Environmental or temporal condition	Effect on Dimensional Stability, Thermal Performance, Resistance to Combustion, etc.
Age	
Temperature	
Moisture	
Sunlight or Weathering	
Fungal or Bacterial	
Cycling	
Animal	
Other (specify)	

V. RESISTANCE TO COMBUSTION

Please supply the requested information in the table below. If information is presented without the testing method, please indicate the basis of the data.

Characteristic Combustion Parameter	Insulating Material Alone		Assembly (as sold)	
	Test	Result	Test	Result
Combustibility				
Flame Spread				
Fuel Contribution				
Smoke Developed				
Gases generated (including concentration)				
Toxicity Due to Combustion				
Ignition Temp. (°F)				
Other (specify)				

Appendix D
LIST OF MANUFACTURERS

Aerolite SPE Corporation
8025 Dixie Highway
Florence, Kentucky 41042
(606) 371-2030

All-Foam Division
Donray Products Company
500 SOM Center Road
Cleveland, Ohio 44143
(216) 449-6450

American Thermcell, Inc.
15546 Cleveland St.
P.O. Box 782
Elk River, Minn. 55330
(612) 421-5600

Apache Foam Products Company
2025 East Linden Avenue
Linden, New Jersey 07036
(201) 486-6723

Approved Insulation
2 Wilson Blvd.
C. Islip, N.Y. 11722
(516) 582-4493

Arkansas Plastics, Inc.
Box 165
Sulphur Springs, Arkansas 72768
(501) 298-3224

Armm Industries, Inc.
90 N.E. 20th Street
P.O. Box 122
Lawton, Oklahoma 73502
(405) 248-7430

BASF Wyandotte Corporation
1609 Biddle Avenue
Wyandotte, Michigan 41814
(313) 282-3300

The polystyrene board manufacturers using BASF Wyandotte Beads
appear on the following two pages.

Alabama

Mahoney Plastics
Decatur, Alabama 35601
205-353-0476

Alaska

Western Insulfoam Corporation
Anchorage, Alaska 99504
907-279-9407

Arizona

Arizona Diversified Products
Phoenix, Arizona 85004
602-253-3191

Arkansas

Arkansas Plastics
Sulphur Springs, Arkansas 72736
501-298-3224

Drew International
Monticello, Arkansas 71655
501-367-6245

Insul Bead Corporation
Gravette, Arkansas 72736
501-787-5991

Stanark Plastics Company
N. Little Rock, Arkansas 72114
501-945-1114

California

Falcon Mfg. of California
Los Angeles, Calif. 90061
213-329-4152

Far Western Foam Products Inc.
Santa Fe Springs, Calif. 90670
213-863-4845

W. R. Grace & Company
South Gate, Calif. 90280
213-567-7764

Marko Foam Products, Inc.
Santa Ana, Calif. 92705
714-835-6441

Vertex, Inc.
Vernon, Calif. 90058
213-582-0751

Vertex, Inc.
Oakland, Calif. 94604
415-763-2070

Western Insulfoam Corporation
Dixon, California 95620
916-753-4010

Western Insulfoam Corporation
Westminster, Calif. 92683
714-893-6567

Colorado

Advanced Foam Plastics
Broomfield, Colorado 80020
303-466-1997

Drew Foam of Colorado
Denver, Colorado 80204
303-534-2342

Rocky Mountain Foam-Form, Inc.
Ft. Collins, Colorado 80529
303-221-5422

Connecticut

Foam Plastic of New England
Prospect, Conn. 06712
203-758-6411

The Gilman Brothers Co.
Gilman, Conn. 06336
203-889-8444

PlastiFoam Corporation
Rockville, Conn. 06066
203-875-6274

Preferred Plastic Company
Putnam, Conn. 06260
203-928-7795

Florida

Dyplast of Florida
Miami, Florida 33144
305-261-4637

W. R. Grace & Co.
Boca Raton, Florida 33432
305-395-2424

Panel Foam, Inc.
Longwood, Florida 32750
305-339-2200

Penn-Plast, Inc.
St. Petersburg, Florida 33714
813-527-2163

Pioneer Plastics
Pensacola, Florida 32504
904-476-9572

The Plasti-Kraft Corp.
Ozona, Florida 33560
813-784-1434

Southeastern Foam Products, Inc.
Ocala, Florida 32670
904-687-2852

Southern Foam Products, Inc.
Live Oak, Florida 32060
904-362-3286

Georgia

Foam Industries Inc.
Conyers, Georgia 30207
404-922-4074

Georgia Foam
Gainesville, Georgia 30501
404-536-8888

W. R. Grace & Company
Atlanta, Georgia 30306
404-448-5880

Insulaire, Inc.
Gainesville, Georgia 30501
404-983-7291

Integrated Insulation Systems
Decatur, Georgia 30035
404-981-7160

Southeastern Foam Products, Inc.
Conyers, Georgia 30207
404-483-4491

Woolley & Company
Doraville, Georgia 30040
404-448-8473

Hawaii

Pacific Allied Products, Inc.
Kaneohe, Hawaii 96744
808-682-2038

Illinois

Approved Styrene Works
Chicago, Illinois 60639
312-523-0510

EPS Industries, Inc.
Dixon, Illinois 61021
815-284-6678

Litteral Lite Corporation
Paris, Illinois 61944
217-466-0370

Indiana

EFF Corporation
Elkhart, Indiana 46514
219-295-4690

Southeastern Foam Products, Inc.
Bargersville, Indiana 46106
317-422-9271

Iowa

Holland Industries
Gilman, Iowa 50106
515-498-7404

Iowa Manufacturing
Indianola, Iowa 50125
515-961-7403

Polycell Industries Inc.
Marion, Iowa 52302
319-377-9495

Kansas

Contour Packaging
Lenexa, Kansas 66051
913-888-4848

EPS Industries, Inc.
Wichita, Kansas 67201
316-942-1494

Star Foam, Inc.
Independence, Kansas 67301
316-331-0470

Kentucky

Day Star Corporation
Somerset, Kentucky 42501
606-679-4836

Drew Foam of Kentucky
Winchester, Kentucky 40391

Louisiana

Drew Foam of Louisiana
Hammond, Louisiana 70401
504-345-0040

Maryland

Amotex Plastics
Baltimore, Maryland 21205
301-485-8585

Foam Industries Inc.
Frederick, Maryland 21701
301-662-3626

Polystyrene Products Co.
Baltimore, Maryland 21220
301-335-2666

Southeastern Foam Products, Inc.
Adamstown, Maryland 21710
301-874-5484

Massachusetts

Dyrelite Corporation
New Bedford, Mass. 02744
617-993-9955

W. R. Grace & Co.
Cambridge, Mass. 02140
617-876-1400

Insulation Technology Inc.
Bridgewater, Mass. 02324

Michigan

Drew Foam of Michigan
Fenton, Michigan 48430
313-629-1531

Falcon Mfg. of Michigan, Inc.
Byron Center, Michigan 49315
616-878-1568

Jacobs Plastics
Adrian, Michigan 49221
517-263-3890

Mar-Foam Inc.
Marlette, Michigan 48453
517-635-6801

Marne Industries
Marne, Michigan 49435
616-677-3501

Michigan Foam Products
Grand Rapids, Michigan 49509
616-452-9611

Pacolite Plastics
Saginaw, Michigan 48604
517-754-3366

Robinson Industries
Coleman, Michigan 48618
517-465-6111

Minnesota

McArthur Company
St. Paul, Minnesota 55114
612-646-2773

Minnesota Diversified Products
Arden Hills, Minnesota 55112

Minnesota Diversified Products
Rockford, Minnesota 55373
612-477-5854

Minnesota Diversified Products
St. Paul, Minnesota 55114
612-645-8952

Poly Foam Incorporated
Lester Prairie, Minn. 55354
612-395-2551

Mississippi

Century Insulation Mfg. Co.
Union, Miss. 39365
601-774-8285

Drew Foam of Mississippi
Pearl, Miss. 39208
601-939-5238

Southeastern Foam Products, Inc.
Grenada, Miss. 38901
601-226-7085

Value Foam
Pearl, Miss. 39208
601-939-0056

Missouri

Diversified Plastics
Nixa, Missouri 65714
417-725-2622

Foam Products
St. Louis, Missouri 63107
314-521-1711

Imperial Foam
Camdenton, Missouri 65020
314-873-5210

Lar-Roy Foam Co.
Cape Girardeau, Missouri 63701
314-334-1844

N.P.S. Corporation
Perryville, Missouri 63775
314-547-8389

Southeastern Foam Products, Inc.
Wentzville, Missouri 63385
314-327-5191

Montana

Big Sky Insulation Unlimited
Belgrade, Montana 59714
406-388-4146

Nebraska

EPS Industries Inc.
Omaha, Nebraska 68137
402-330-1700

Mid-America Industries
Mead, Nebraska 68041
402-624-6611

New Hampshire

Avilite Industries
Marlborough, N.H. 03455
603-876-3313

New Jersey

Poly Molding Corporation
Haskell, New Jersey 07420
201-835-7161

U.S. Mineral Products Co.
Stanhope, New Jersey 07874
201-347-1200

New Mexico

Southwest Insulbead
Albuquerque, New Mexico 87102
505-243-0666

New York

Poly Fab Products Inc.
Menants, New York 12204

Polystyrene Molders, Inc.
Newfield, New York 14867
607-564-7035

Thermal Foams, Inc.
Buffalo, New York 14207
716-874-6470

North Carolina

Foam Industries
Graham, North Carolina 27253
919-226-9873

Foam Molding Inc.
Asheboro, North Carolina 27203
919-629-1495

Southeastern Foam Products, Inc.
Burlington, North Carolina 27215
919-227-9041

Ohio

Clark Industries
Columbus, Ohio 43201
614-294-3761

Foam Master Inc.
Cincinnati, Ohio 45241
513-771-2266

Foam Master Inc.
Twinsburg, Ohio 44087
216-425-3188

Pacemaker Plastics
Dover, Ohio 44622
216-364-8862

Southeastern Foam Products Co.
New Middleton, Ohio 44442
216-542-2964

Southern Ohio Foam
Lebanon, Ohio 45036
513-932-7755

Stolle Corporation
Sidney, Ohio 45365
513-492-1111

Strata Foam Corporation
Akron, Ohio 44309
216-929-1811

Oklahoma

Lin Manufacturing
Clinton, Oklahoma 73601
405-323-3010

Sequoyah Foam Company
Sallisaw, Oklahoma 74955
918-775-9741

Tri State Foam Company
Tulsa, Oklahoma 74116
918-835-8241

Pennsylvania

EFB Corporation
Lancaster, Penna. 17604
717-397-2165

Foam Products Corp.
York Haven, Penna. 17370
717-266-3671

French Creek Products
Roversford, Penna. 19468
215-948-6770

W. R. Grace & Company
New Castle, Penna. 16102
412-654-7721

Insul-Board
Erie, Penna. 16505
814-833-7400

Southeastern Foam Products, Inc.
Fogelsville, Penna. 18051
215-398-1177

Toyad Corporation
Latrobe, Penna. 15350
412-537-9000

South Carolina

Dyplast of South Carolina
Starr, South Carolina 29684
803-296-3424

South Dakota

Webster Industries
Webster, South Dakota 57274
605-345-3131

Tennessee

Amotex Plastics
Nashville, Tenn. 37212
615-254-1381

Drew Foam of Memphis, Inc.
Memphis, Tenn. 38103
901-525-1569

Texas

W. F. Martin Co.
Knoxville, Tenn. 37917
615-523-0401

Southeastern Foam Products, Inc.
Jonesboro, Tenn. 37659
615-753-5621

U. S. Foam Company
Memphis, Tenn. 38107
901-523-0357

Texas

Alamo Foam Company
San Antonio, Texas 78203
512-222-1286

Drew Foam of Houston
Houston, Texas 77001
713-224-3486

Drew Tex Foam Company
Waxahachie, Texas 75165
214-937-6390

Emerson Plastics
Houston, Texas 77002
713-225-2095

W. R. Grace & Company
Houston, Texas 77008
713-864-2657

Insulation Materials
Fl. Worth, Texas 76117
817-281-5929

Therma Foam Company
Fl. Worth, Texas 76106
817-429-7350

United Foam Industries
Irving, Texas 75070
214-255-8595

Utah

Marko Foam Products Inc.
Salt Lake City, Utah 84104
801-972-1354

Virginia

General Foam Plastics Corp.
Norfolk, Virginia 23502
703-857-0153

Radva Plastics Corp.
Radford, Virginia 24141
703-639-2458

Southeastern Foam Products, Inc.
Petersburg, Virginia 23803
804-733-1810

Washington

W. R. Grace & Company
Auburn, Washington 98002
206-852-5725

Western Insulfoam Corporation
Kent, Washington 98031
206-242-9424

Wisconsin

W. R. Grace & Company
Milwaukee, Wisconsin 53208
414-344-6667

Mid West Plastics Inc.
Pembine, Wisconsin 54156
715-324-5555

Plymouth Foam Products
Plymouth, Wisc. 53073
414-893-0535

Sandra Corporation
North Prairie, Wisc. 53153
414-392-9126

Southeastern Foam Products, Inc.
Elkhorn, Wisconsin 53121
414-723-2580

Spectrum Manufacturing
West Allis, Wisconsin 53214
414-475-1215

B.F. Goodrich General Products Div.
33095 Bainbridge Road
Solon, Ohio 44139
(216) 248-4391

Benoit, Inc.
635 North Prior Avenue
St. Paul, Minn. 55104
(800) 328-1436

Bonded Insulation Co., Inc.
77 Pauling Street
Hagaman, New York 12086
(518) 842-1470

Brouk Company
1367 S. Kingshighway
St. Louis, Missouri 63110
(314) 533-9022

Carney Insulation Corporation
4930 W. 77th St. Suite 315
Edina, Minnesota 55435
(612) 835-3717

Casco Mineral Wool Division
(formerly Midwest Insulations Div.)
L.C. Cassidy & Son, Inc.
1918 S. High School Road
Indianapolis, Indiana 46241
(317) 241-6391

Cellin Manufacturing
P.O. Box 688
Springfield, VA 22150
(703) 550-7277

The Celotex Corporation
Building Products Division
1500 North Dale Mabry Highway
Tampa, Florida 33607
(813) 871-4418

Certain-Teed Corporation
P.O. Box 860
Valley Forge, Pennsylvania 19482
(215) 687-5000

Coastal Foam, Inc.
129 Commerce Street
Apalachicola, Florida 32320
(804) 653-8892

Cook Paint & Varnish Company
P.O. Box 389
Kansas City, Missouri 64141
(816) 471-4800

CPR Division
The Upjohn Company
555 Alaska Avenue
Torrance, California 90503
(213) 320-3550

Diversified Insulation, Inc.
P.O. Box 188
2705 West Highway 55
Hamel, Minnesota 55340
(612) 478-6614

Dow Chemical, U.S.A.
Granville Research Center
P.O. Box 515
Granville, Ohio 43023
(614) 587-4351

Drew Foam Company, Inc.
311 Godfrey
Monticello, Arkansas 71655
(501) 367-6246

Dryvit System, Inc.
420 Lincoln Avenue
Warwick, Rhode Island 02888
(401) 463-7150

EFF Corporation
223 Middleton Run Road
Elkhart, Indiana 46514
(219) 295-4690

Elwin G. Smith Division
100 Walls Street
Pittsburgh, Pennsylvania 15202
(412) 761-7474

Falcon Manufacturing of Michigan, Inc.
8240 Byron Center Road
Byron Center, Michigan 49315
(616) 878-1568

Foam Master, Inc.
2292 E. Aurora Rd.
P.O. Box 306
Cleveland, Ohio 44087
(216) 425-3188

Foam Plastics of New England
New Haven Road - Rte. 69
Prospect, Conn. 06712
(203) 758-6411

Foam Products, Inc.
Gay Street
York Haven, Pennsylvania 17370
(717) 266-3671

Foam Systems Corporation
1980 Atlantic Avenue
P. O. Box 5347
Riverside, CA 92517
(714) 684-8333

Forty-Eight Insulations, Inc.
P. O. Box 1148
Aurora, Illinois 60507
(312) 896-4800

G.A.F. Corporation
140 W. 51st Street
New York, N.Y. 10020
(212) 582-7600

General Plastics Manufacturing Company
3481 South 35th Street
Tacoma, Washington 98409
(206) 383-1631

The Gilman Brothers Company
Gilman, Connecticut 06336
(203) 889-8444

Grefco Inc.
Building Products Division
3450 Wilshire Blvd.
Los Angeles, California 90010

Hamilton Mfg. & Dist. Inc.
118 Market St.
P.O. Box 1426
Twin Falls, Indiana 83301
(208) 733-9689

Hexcel
11711 Dublin Blvd.
Dublin, California 94566

Homasote Company
Box 7240
W. Trenton, New Jersey 08628
(609) 883-3300

Hurstline Sales, Inc.
Route 7, Gilbert Lane
Concord, Tennessee 37720
(615) 966-5841

In-Sol, Inc.
1200 E. 4th
P.O. Box 971
Taylor, Texas 76574
(512) 352-5513

Insta Foam Products, Inc.
2050 N. Broadway
Joliet, Illinois 60435
(815) 726-6241

International United Chemical
645 E. 60th St.
Los Angeles, California 90003

Regional Manufacturers:

High Springs, Florida
1320 S. Main Street
High Springs, Fl 32643
(904) 454-3430

Chicago, Illinois
3845 Carnation Avenue
Franklin Park, Illinois 60131
(312) 678-7500

Lewiston, Maine
2 Avon Street
Lewiston, Maine 04240
(207) 783-2029

Fort Worth, Texas
4912 Rondo Drive
Ft. Worth, TX 76106
(817) 625-5371

Kansas City, Missouri
113 So. Marietta St.
Excelsior Springs, MO 64024
(816) 781-1188

San Francisco, California
305 Mathew Street
Santa Clara, California 95050
(408) 244-6615

Charlottesville, Virginia
1000 Harris Street
Charlottesville, Virginia 22902
(804) 295-2131

Seattle, Washington
19016 - 13th Pl. South
Des Moines, Washington 98148
(206) 242-9990

Los Angeles, California
645 E. 60th Street
Los Angeles, California 90001
(213) 232-3445

Iowa Excel Corporation
P. O. Box 353
West Des Moines, Iowa 50265

(515) 225-6878

Iowa Manufacturing Specialists, Inc.
400 E. Iowa
Indianola, Iowa 50125

(515) 961-7403

Johns-Manville Sales Corporation
Ken-Caryl Ranch
Denver, Colorado 80217

(303) 979-1000

Lion Oil
Eldorado, Arkansas 71730

(501) 863-3111

Metal Building Interior Products Co.
1176 East 38th Street
Cleveland, Ohio 44114

(216) 431-6400

Mid-America Industries, Inc.
Rt. 1, Box 101
Mead, Nebraska 68041

(402) 624-6611

Mono-Therm
P. O. Box 934
551 So. Yosemite Avenue
Oakdale, California 95361

(209) 847-3055

National Insulation, Inc.
1601 Garfield Avenue
Bay City, Michigan 48706

(517) 894-0647

North American Compounding
No Address

Olin Corporation
120 Long Ridge Road
Stamford, Connecticut 06904

(203) 366-2262

Oren Corporation
P. O. Box 2446
Muncie, Indiana 47302

(317) 288-9988

Owens-Corning Fiberglas
Fiberglas Tower
Toledo, Ohio 43659

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Panel Era, Inc.
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(801) 486-3474

Panel Foam, Inc.
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(305) 339-2200

Patten Building Supply
435 Cleveland Avenue
Winnebago, MN 56098

(507) 893-3112

The Perlite Institute, Inc.
45 West 45th Street
New York, N.Y. 10036
(212) 265-2145

NOTE: The members of the Perlite Institute (listed by State) appear on the next 3 pages.

Perlite Producers in the United States

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P.O. Box 6824
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(205) 956-9545

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1518 Simpson Way
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(714) 741-1733

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Dicalite Division
3450 Wilshire Blvd.
Los Angeles 90010
(213) 381-5081

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11831 Vose Street
North Hollywood 91605
(213) 875-0440

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P.O. Box 308
Antonito 81120
(303) 376-5475

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Ken-Caryl Ranch
Denver 80217
(303) 979-1000

Persolite Products, Inc.
P.O. Box 105
Florence 81226
(303) 572-3222

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Vero Beach 32960
(305) 562-3518

Chemrock Corporation
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North Edgewood Avenue
Jacksonville 32208
(904) 355-0096

Zonolite-Construction Products Division
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Lake Zurich 60047
(312) 438-2363

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Building Products Division
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Oak Brook 60521
(312) 654-4500

Mica Pellets, Inc.
1120 Oak Street
De Kalb 60115
(815) 756-9525

Silbrico Corporation
6300 River Road
Hodgkins 60525
(312) 735-3322

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(317) 362-6000

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Wilders, Newport 41071
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American Perlite Products, Inc.
P.O. Box 128
Gilliam 71029
(318) 296-4316 and 222-3638

Filter-Media Co. of Louisiana, Inc.
P.O. Box 222
Reserve 70084

MAINE:

Chemrock Corporation
P.O. Box 177
Thomaston 04861
(207) 594-8225

MASSACHUSETTS:

Whittemore Perlite Co., Inc.
Dundee Park
Andover 01810
(617) 470-0317

Zonolite-Construction Products Division
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Cambridge 02140
(617) 876-1400

MISSOURI:

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1367 S. Kingshighway
St. Louis 63110
(314) 533-9022

NEW JERSEY:

The Schundler Company
P.O. Box 249
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(201) 287-2244

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Buffalo Perlite Division of
Pine Hill Concrete Mix Corporation
100 Sugg Road
Buffalo 14225
(716) 634-5600

Scolite International Corporation
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(518) 272-2400

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P.O. Box 158
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(704) 279-2325

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The Cleveland Builders Supply Co.
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Cleveland 44113
(216) 621-4300

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(817) 834-1944

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